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The 1999 Assessment of Pollock (*Pollachius virens*) in NAFO Divisions 4VWX and Subdivision 5Zc

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Abstract

In 1998, landings increased to 14,371 t from 11,936 t in 1997. With the exception of large mobile gear, most sectors were able to catch close to their quota. Landings in the small mesh silver hake fishery decreased to 6 t in 1999 from 10 t in 1998. Landings of pollock in the domestic redfish fishery, which also uses relatively small mesh gear, were 436 t. In 1999, the TAC of 12,000 t was prorated to a 15 month fishing year ending March 31, 2000 (13,440 t). Landings to the end of August 1999 were 5,055 t. In constrast to 1998, members of most gear sectors indicated that they would not be able to catch their quota.

The stock status evaluation was based on an analytical assessment employing landings statistics, sampling for size and age composition of the commercial catch, trends in commercial fishery catch rate, survey information and examination of the spatial distribution of the fishery and the resource. Available indicators of stock status indicate that biomass is less than average, recent recruitment has been poor, there is an absence of older fish in the population, and there are spatial changes in the resource and fishery distributions that are worrisome. The $F_{0.1}$ catch for the fishing year commencing April 1, 2000 is 7000 t.

Résumé

Les débarquements ont augmenté de 1997 à 1998, passant de 11 936 t à 14 371 t. La plupart des secteurs, à l'exception de celui des gros engins mobiles, ont presque atteint leur quota de capture. Les débarquements de la pêche à petit maillage du merlu argenté ont diminué, passant de 10 t en 1998 à 6 t en 1999. Les débarquements de goberge dans les pêches domestiques du sébaste, qui emploient aussi des engins à petit maillage, s'élevaient à 436 t. En 1999, le TAC de 12 000 t a été réparti proportionnellement sur la saison de pêche de 15 mois qui se termine le 31 mars 2000 (13 440 t). Les débarquements à la fin d'août 1999 étaient de 5 055 t. Les pêcheurs de la plupart des secteurs d'engins ont fait savoir qu'ils seraient incapables de prendre leur quota, une situation qui contraste avec celle de 1998.

L'évaluation de l'état des stocks a été basée sur une évaluation analytique qui utilise des statistiques de débarquements, des échantillonnages de la composition en taille et âge des prises commerciales, des tendances relatives au taux de capture des pêches commerciales, des relevés et des examens de la distribution spatiale des pêches et de la ressource. Les indicateurs disponibles de l'état des stocks montrent que la biomasse est inférieure à la moyenne, que le recrutement récent a été faible, qu'il y a une absence de poissons plus âgés dans la population et que les changements spatiaux dans la distribution de la ressource et des pêches sont préoccupants. La prise $F_{0.1}$ pour la saison de pêche commençant le 1er avril 2000 est de 7000 t.

Introduction

Management Unit

The management unit for the pollock resource in Maritime waters includes NAFO Divs. 4VWX and Subdiv. 5Zc. The convention for the Canadian management unit was established following a review in 1989 (Annand et al. 1989), which involved examination of results of egg and larval surveys, meristic and morphometric studies, and tagging work. Prior to this, the convention for the management unit was NAFO Divs. 4VWX and Subarea 5. Within the management unit, however, the likelihood of multiple stocks seems high, as differential movement of tagged juvenile fish has been noted depending on point of release, along with significant variation in meristic and morphometric characters, growth rates, and multiple discrete spawning areas (Annand et al. 1989).

History and Description of the Fishery

Landings and TACs since 1974 are shown on Fig. 1 and Table 1. Landings from 1974 to 1980 averaged about 28,000 t, rose through the early 1980s to 45000 t in 1987. Since then, landings have sharply decreased. The TAC rarely constrained overall fishery landings, although for a period of five consecutive years in the late 1980s, the TAC was either met or exceeded. The 1998 total allowable catch (TAC) for 4VWX5Zc pollock was 20,000 t, with landings of 14,381 t. With the exception of the large mobile gear sector (Mobile > 100'), most sectors were able to catch close to their allocations. In contrast, landings for the partial year 1999 were 5,055 t (includes landings until the end of August) against a 15 month quota of 13,440 t (Fig. 1, Tables 1,2). In the 1999 fishing year, members of most sectors had more difficulty catching their quotas through the first two trimesters (Table 2).

The 1998 and 1999 landings continue the recent trend of comparatively small contributions to total landings in the eastern portion (4VW) of the management unit (Table 3, Fig. 2). However, management measures have had considerable impact on the fishery in the 4VW component in recent years. For example, the cod management unit in 4VsW has been closed since September 1993, thus restricting opportunities for pollock fishing on the eastern Shelf. Further dissagregation of landings by NAFO Subdivision (Fig. 3) indicate that landings in 4X have declined since 1991 except for slight increases in 1997 and in 1998. While landings from 4V were significant through the late 1980s', they have dropped markedly until 1993, when they recovered slightly. Landings from 5Zc (Georges Bank) peaked in 1993, and have declined thereafter until 1998 when landings showed an increase to its highest total since 1994 (Fig. 3). Examining the pattern of landings within 4X5 at a finer level of resolution, that of unit area, reveals that the fishery has become increasingly concentrated in a few unit areas in the western portion of 4X (4Xp, 4Xq), whereas in 1994 more unit areas contributed to overall removals (Figs. 4 and 5). However, this concentration seems somewhat less pronounced in 1999 than was the case in 1998.

The spatial distribution of the pollock fisheries is further summarized in Figs. 6 to 7, which show the monthly distribution of 1998 landings of TC 1-3 and 4+ trawlers, respectively. The smaller trawlers largely fish in 4X, with key areas being German Bank, Georges Bank and the lower Bay of Fundy. The larger trawlers are more generally distributed throughout the management unit, with significant landings made from the edge of the Scotian Shelf in 4W and Georges Bank. To assess recent changes in the fishery distribution, we also show comparable information for the 1991 fishery (Figs. 8,9). A difference which is apparent in the comparison of the fishery distribution of small mobile gear is that the October/November fishery apparent in 4VW is no longer pursued. For large mobile gear, the fishery that was evident on the Shelf edge in 1991 was not present in 1998.

Table 4 shows landings information aggregated into trimester and gear categories[1]. A variety of fishing gear is used in the pollock fishery, including primarily mobile gear (otter trawls) and fixed gear (gill nets, handlines and longlines). As indicated in Fig. 10, there have been significant changes in the relative importance of gear types over time. The relative contribution of larger draggers has been much diminished, whereas the contribution of smaller draggers and fixed gear has been steadily increasing.

The recent monthly distribution of landings by gear sector shows an increase in the proportion of landings in the later months of the year (Table 5). Seasonal trip quotas and trip limits were introduced in 1986 for the mobile gear sector < 65'. For example, when 1987 and 1988 is compared with the 1990s, the quota for the small gear sector for these two years was caught by August 31 with very little quota remaining for the rest of the year and thus very little fishing was done from September to the end of December. In 1989, "CHP" management was put in place for 4X and 5Zc where the fishery was limited by the aggregate total for cod, haddock, and pollock. Under the 1989 management plan, the fishery for the small mobile fleet was closed at the end of June. In 1990 the CHP management continued for the first half of the year in Div 4X resulting in very little pollock been taken. The last 3 months of 1990 vessel quotas were used to divide up the remaining quota for the mobile gear < 65'.

A recent development of note in the domestic fishery has been the expansion of the redfish fishery on the Scotian Shelf in 1996. This fishery uses smaller mesh size (90-100 mm) than the rest of the domestic otter trawl fishery. Landings of pollock in the redfish fishery in 1998 were 436 t.

Landings of pollock in the foreign silver hake fishery decreased from 1996 (135 t) to 1998 (10), 9 t Cuba and 1 t Russia. Foreign landings to date in 1999 are 6 t, excusively by Cuba.

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[1] Mobile gear included bottom otter trawls (side and stern), midwater trawls (side and stern), bottom pair trawl, midwater pair trawl, shrimp trawl, and Danish and Scottish Seine. Fixed gear included gillnet (set or fixed), longline, jigger, troller lines, mechanized squid jigger, handline (baited),trap, pot, weir and miscellaneous.

Using a spatial mapping approach, trends in the total area occupied by the mobile gear fishery were examined. The mapping process begins by applying a grid to the geographic area containing the data and calculating an attribute value (in this instance the average pollock catch rate) for each of the individual grid cells. These values are determined by calculating a distance weighted mean from each point whose sampling radius overlaps the center of that cell. The distance weighted averages for each cell are calculated as:

$$Z_c = \sum_{i=1}^{i=n} (f_i w_i(d) z_i) / \Sigma(f_i w_i(d)),$$

where z_i = the catch rate of pollock caught at the ith location , f_i is the number of observations at that point location (in this instance 1 for each trawl location), and w(d) is the distance weighting. The distance weighting calculation is controlled by the user. The user can define both an inner (α) and outer sampling radius (γ) which together make up the total sampling radius. In this instance, the outer sampling radius was 14 km. If the distance from the point location to the center of the grid cell is > ($\alpha+\gamma$) then the weighting is 0, if the distance is less than α then weighting is 1, if the distance is > α and less than ($\alpha+\gamma$) then the weighting is calculated as

$$w(d) = (2 \times (1 - \beta^1))^{(d / (\beta^1 \times \gamma))} \times ((\gamma - d) / \gamma)$$

where d is the distance from the point to the center of the grid cell, and β is the defined decay rate (for $\beta \leq 0.5$, $\beta^1=\beta$, else $\beta^1=1-\beta$). β,s >0 and < 0.5 give exponential decays, β=0.5 gives a linear decay, β,s > 0.5 and < 1.0 give inverse exponential decays (domes), while β=1.0 gives no decay.

Results of this spatial mapping analyses indicated that from 1990 to 1998, the area occupied by both the small (Tonnage Classes 1-3) and large trawlers (Tonnage Classes 4+) has declined (Fig. 11). However, over the same time period, the number of large trawlers involved in the fishery has declined, as have the landings by that sector.

During consultations with industry in September of 1999 (Table 6), fishermen reported generally poor fishing throughout the management area. Notable exceptions to this were eastern 4X and 4W in the Emerald Basin and area west of Sambro Basin where fishermen experienced the best fishery in years; this is opposite of what has been seen for the past few years (pollock now scarce in western 4X). Fishing on Georges Bank was noted to have started slowly but improved in August and September. As was noted in the previous assessment, fish were not found in some of the traditional areas, the size range was variable and there was a lack of large fish.

Catch at Length and Age

Results of age determination testing done in 1999 are summarized in Appendix I. The agreement "within reader" was judged to be satisfactory. Comparisons with the

previous age reader were also generally satisfactory although some potential bias was noted for the older ages (8+). Overall, there has been a slight decline in mean commercial fishery weights at age through the late 1980s and early 1990s, but the decline appears to have stabilized by the mid 1990s (Fig. 12). At the oldest ages in 1996 and 1997, there were some anomously high weights calculated, but those appear related to a very small sample size of such fish in recent years.

The Canadian catch at age was developed using the approach established in Neilson and Perley (1996). For this assessment, the 1998 catch at age was updated with samplings and landings information not available in the last assessment and the 1999 catch at age is provided up to August 31. In general, sampling levels seemed adequate for the construction of the catch at age in both years, although there are fewer samples available by the end of the second trimester in 1999 compared with 1998. Recently, samples have been collected by National Sea Products Limited and various other fishing groups have significantly improved the sampling coverage. Figs. 13 and 14 summarize the components of the 1998 and 1999 catches at age disaggregated by area, gear and trimester in relation to the landings for that combination.

Landings from the vessels participating in the small mesh gear silver hake fishery were attributed to the foreign small mesh gear fishery for the purpose of constructing the catch at age. An age-length key derived in combination from the 1999 survey and commercial samples was applied to the length-frequency samples available from the Observer Program.

As in the past assessment, length-weight parameters were calculated as the average *a* and *b* parameter values from the summer RV surveys over the past five years. Since recent spring or fall surveys are not available, the summer values were used for the 1st and 3rd trimesters as well.

The resulting catch at age and weight at age appear in Tables 7 and 8, respectively. The 1999 catch composition is shown in Fig. 15, both with respect to the predicted age composition and the ten-year average age composition. The 1999 age distribution continues the trend seen last year of considerably fewer older fish observed than predicted. Age 5 (1994 year-class) fish dominate the 1999 catch at age with the age 7+ fish lower than the predicted value although comparable with the ten year mean. Age 3 fish were also less evident in the catch at age than predicted, and compared with the 10 year average.

The catch at age is also shown on a proportional basis (each age shown as a proportion of the total caught in a given year) in Fig. 16 and Table 9. Both strong (ie. 1979) and weak year-classes (ie. 1978) are clear in this representation of the data. The comparative absence of older fish is also apparent, but during 1974 to 1980, a similar absence is noted.

Instantaneous growth rates were calculated from the commercial fishery catch at age (Fig. 17) over ages 3 to 4, ages 4 to 5 and ages 5 to 6. Since 1992, these growth rates have increased, and in 1998 are the highest observed since 1990.

Distribution and Abundance

Research Surveys

The overall trend in catch per tow is shown in Fig. 18. Regarding abundance trends from the survey, results for pollock are considered typically highly variable, and it is difficult to track cohorts from year to year (Fig. 19). Given these observervations, otoliths collected during surveys have not been aged since 1997. However, some figures from previous assessments that contained age-structured data from the surveys are repeated here, as they are illustrative of important points.

Age by age distribution plots for 5 year blocks of summer surveys are presented in Figs. 20 a-c. There appears to be a comparative absence of fish of age 8+ in the 1993 to 1997 period compared with the two earlier time periods. Survey length composition information shows that there were fewer large fish in 1998 and 1999, compared with the ten-year average (Fig. 21).

Fulton's condition factor (weight/length^3) was also calculated for several length-classes of pollock collected during research vessel surveys. There was a trend of declining condition from 1989 to 1995 for fish larger than 30 cm in Div. 4X (Fig. 22), but more recently, condition has been variable and without trend. Moreover, no trend was observed for pollock captured in Divs. 4W and 4V.

A measure of resource concentration is the proportion of the survey stations encompassing 75% of the annually estimated survey biomass. The pollock resource became more evenly distributed from 1970 to 1992, and has become less evenly distributed (more concentrated) from 1992 to the present (Fig. 23). A measure of the geographic range is the proportion of annual surveys sets where pollock occurs. The proportion of non-zero survey sets has followed an increasing trend until 1993, and decreased until 1998 (Fig. 23). For this resource, these measures of spatial distribution are relatively new, and their interpretation is still under development. Taken together, however, these two measures of the spatial distribution of pollock indicate considerable changes in the patterns of pollock distribution through the 1990s.

Industry Survey

A collaborative survey with ITQ mobile gear operators has been ongoing for the past five years. While the survey was not used in the assessment as an index of abundance,

it provides important information on distribution and size composition and the catch rates can be compared qualitatively. The distribution of catches over the past four years of the survey is shown on Fig. 24. The geographic distribution of the catches in 1999 appears similar to that observed in 1998. A striking contrast in the size composition of the catch was also noted, with the catch in 1998 and 1999 being considerably smaller in length, on average. There was also a relative absence of fish larger than 40 cm in 1998 and 1999 (Fig. 25). There was a slight increase in mean catch per tow (Fig. 26) from 1998 to 1999 but the values remain low compared to earlier years of the survey.

Commercial Catch Rates

As reported in the previous stock assessment, a standardized catch rate series was developed for mobile gear. Catch and effort data from the International Observer Program (IOP) were included[2] for tonnage classes 4+. For the smaller tonnage classes, data from ZIFF were used. The data for 1989 were omitted from the analyses for TC 1-3 since this was the year when a combined cod-haddock-pollock quota was attempted for areas 4X5 (Mohn et al. 1990), and anomolously high pollock catch rates were observed.

Trips were selected which had directed pollock catches (when pollock landings were equal to or greater than 50% of the total landings by weight) and where effort and catch are both greater than zero and grouped to the sub-trip level from 1982 to 1999 (first two trimesters of 1999 only). Factors in the catch rate standardization included vessel, year, month, tonnage class, NAFO unit area and mesh type (square *vs* diamond). In instances prior to and including 1993 where the mesh type field was blank, it was assumed to be diamond. In 1994, all such records were deleted. In 1995, if the mesh type field was blank, it was assumed to be square mesh. We included NAFO unit areas 4Vn, 4Vs, 4Wg, 4Wh, 4Wk, 4Wl, 4Xm, 4Xo, 4Xp, 4Xq, 4Xr, 4Xs and 5Zj only in the analyses, as other areas did not have sufficient data to warrant inclusion. Even though area 5Yb was considered to have sufficient data, it was excluded, since there is thought to be landings incorrectly attributed to that area.

All main effects were found to be significant and gave patterns in catch rates that were expected and intuitive (ie. increasing catch rate with increasing tonnage class, seasonal patterns in catch rates which were consistent with previously published results (Figs. 27-29, Hanke 1993). Two tonnage classes had relatively few observations of catch and effort (TC 1 and 6), and they were omitted from the final run. Also, catch rates during the May through October period were judged sufficiently similar to be combined into one level for the analysis of seasonal effects on catch rates. The results of the multiplicative analyses are shown in Appendix II. As with previous analyses of catch

[2] Four ORACLE IOP tables were used to generate catch rate data: TRIVES, GEA,CAT and SETNO tables. To extract the appropriate data, these tables were linked to each other by the trip number which is the key field for all tables. Gear is then keyed to set number by the gear code and set number is keyed to the catch by the set number, yielding an output file with pollock dat selected for area, gear type, tonnage class, main species caught (MSPEC= pollock)

rates for this resource, the amount of variation in observed catch rate explained by the model was comparatively low (17%).

As explained in the following section, this year's assessment used data from 4X5 only, as compared with previous years, when data from the entire management unit were employed. The catch rate series for 4X5 employed only smaller otter trawlers (TC1-3). The two series show similar trends (Fig. 30).

Sequential Population Analyses:

Estimation of Stock Parameters

The adaptive framework of Gavaris (1988) was used to calibrate the sequential population analysis with the commercial catch rate data shown in Table 10. Last year, the following model formulation was used:

$C_{a,y}$ = catch	a= 2 to 12, y = 1974 to 1999.67 (first two trimesters of 1999)
$I_{a,y}$ = OTB catch rates	a= 3 to 9, y = 1982 to 1999.67

where a is age, and y is year. The model provided estimates of the abundances of ages 4 to 12.

The OTB catch rate index was considered a midyear index and compared with midyear population abundance. The statistical error in the survey size sample data was assumed to be independent and identically distributed and the error in the catch at age was assumed negligible. Natural mortality, M, was assumed constant at all ages and equal to 0.2. The fishing mortality rate, F, for the oldest age (12) was taken as the arithmetic average of ages 7, 8, 9 and 10.

Based on a yield per recruit analysis documented in Neilson and Perley (1996), the $F_{0.1}$ fishing mortality was taken to be 0.30.

The updated ADAPT run using last year's formulation continued to display time trends in residuals, and a pattern of declining trends of year-class estimates with additional data (the so-called retrospective pattern) was apparent for many year-classes, particularly the larger ones.

The following changes to the ADAPT model formulation resulted in an analyses that showed significant improvements in the residual (Fig. 31) and retrospective patterns:

1. Include catch and index data from NAFO Divs 4X5 only, 1982 to 1999.67. This change necessitated recalculating the catch at age for the smaller area. In the time available, it was only possible to complete the catch at age reconstruction as far back as 1982. Also, the reconstruction for 4X5 includes Canadian

removals only (foreign removals were only 2-4% of the total landings in 1982 to 1984, and the fishery was almost exclusively domestic thereafter).
2. Include TC 1-3 mobile gear catch rates in the catch rate index only.
3. Include index ages 4-7 only.

VPA Results

The complete stock assessment results are shown in Appendix III.

Age 5+ population biomass was at the maximum in 1985 then fell steadily to a minimum in 1995 (Fig. 32). With comparatively low quotas and the recruitment of the moderate 1992 year-class, the population has grown slightly since 1995. Recent recruitment has followed a declining trend since the 1992 year-class.

The exploitation rate at ages 4-7 reached a maximum in 1991, then declined until 1996 (Fig. 33). Since then, the exploitation rate has been variable, but close to the $F_{0.1}$ target (24%, $F_{0.1}$=0.30). The 1999 exploitation level is presently estimated to be the lowest observed since 1982.

Prognosis

During recent years, there has been a change in the pattern of partial recruitment to the fishery, with older ages less available (see F at age tables in Appendix III) . Projections assuming full recruitment for older ages have led to a mismatch between observed and predicted age compositions. To account for this, a dome shaped partial recruitment pattern was used. The revised partial recruitment vector is shown in comparison with that used last year in the text table that follows:

Age	Last Year's PR	This Year's PR
2	.01	.01
3	.01	.01
4	.40	.45
5	.80	.80
6	.90	1
7	1	.6
8	1	.15
9	1	.05
10	1	.05
11	1	.05
12	1	0

Average weights at age used for the projection are from the fishery and those observed during the period 1992-1996, a period of stability in the weight at age data (Fig. 12). These average weights at age were then converted to beginning of year weights at age for calculation of beginning of year biomasses.

Projections are provided for the fishing year commencing April 1, 2000 and ending March 31, 2001. Based on discussions with industry during review of the stock assessment, it was assumed that total additional removals for the current fishing year ending March 31, 2000 will be 4000 t, on top of the landings reported until the end of the second trimester of 1999 (5055 t). The complete projection results are shown in Appendix III.

With these conditions, $F_{0.1}$ landings for the fishing year commencing April 1, 2000 would be about 5700 t in 4X5. Growth in biomass by the beginning of 2001 fishing year implied from the above fishing option would be about 20% (Fig. 34). In the fishing year starting April 1, 2000 a catch of 5700 t implies a negligible probability of not obtaining a 10% increase in biomass by the beginning of fishing year 2001 (Fig. 35).

Consistent with the approach to the assessment, the projection results provide guidance for 4X/5 only. Using the proportions of pollock biomass observed during surveys of 4VW compared with 4X over the past four years as a rough approximation of the distribution of the resource, it is suggested that the estimated catch at $F_{0.1}$ for 4X/5 be increased by 20% to about 7000 t to give an estimated $F_{0.1}$ catch for the management unit as a whole.

Summary

This year, the stock assessment includes a compilation of attributes of stock status. While the attributes are generally those traditionally included in an assessment, other more novel indicators are also included. Summarizing these attributes in a tabular format facilitates comparison and should be an aid for decision makers (Table 11). Most of these attributes indicate that the pollock resource remains depleted. Biomass is less than average, recent recruitment has been poor, there is an absence of older fish in the population, and there are spatial changes in the resource and in the fishery distributions that are worrisome. Caution in establishing harvest levels is required.

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Table 1. Pollock landings[1] (t round fresh) by country for NAFO Divs. 4VWX and Subdiv. 5Zc
(Source: Neilson and Perley, DFO ZIFF & IOP Data)

	Canada	Japan	France[2]	Fed. Rep. Germany	German Dem. Rep.	Cuba	USSR (Russia)	USA	Spain	Other	Total
1974	24975	40		149			2301	435	1500	61	29461
1975	26548			236	95		2004	403	708	124	30118
1976	23565			994	24		1466	443	303	385	27180
1977	24653	1		368			182	325		53	25582
1978	26801	110	33			141	502	451			28038
1979	29967	19	23			50	1025	391		7	31482
1980	35986	81	99			32	950	443			37591
1981	40270	15	90				358	918			41651
1982	38029	3	44			84	297	840			39297
1983	32749	6	22			261	226	1324			34588
1984	33465	1	46			123	97	1691		1	35424
1985	43300	17	77			66	336				43796
1986	43249	51	77			387	564			4	44332
1987	45330	82	28			343	314				46097
1988	41831	1				225	1054				43111
1989	41112	1				99	1782				42994
1990	36178					261	1040				37479
1991	37931	38				459	1177				39605
1992	32002	72	9			1015	1006				34104
1993	20253					644	176				21073
1994	15240					10					15250
1995	9781					58					9839
1996	9145					129	6				9280
1997	11927					64					11991
1998	14371					9	1				14381
1999[3]	5049					6					5055

[1] Data from 1996 to 1998 are provisional.

[2] Includes mainland France and St. Pierre and Miquelon

[3] 1999 Data from January 1 to August 31

Table 2. 1998 and 1999 pollock fishing activity by gear sector, 4VWX5Zc pollock.

1998(Full Year)[1]

Gear Sector	Quota	Catch	% of Quota
Fixed <45'	5613	4223	75
Fixed 45-64'	147	115	78
Mobile <65' (ITQ)	4550	3667	81
Mobile <65' (Generalists)	26	8	31
Mobile 65'-100'	1300	1289	99
Vessels >100'	8364	5116	61
Totals	20000	14418	72

1999(to Sept. 22)[2]

Gear Sector	Quota	Catch	% of Quota
Fixed <45'	3772	1970	52
Fixed 45-64'	99	41	41
Mobile <65' (ITQ)	3056	1575	52
Mobile <65' (Generalists)	19	17	89
Mobile 65'-100'	746	195	26
Vessels >100'	5748	1824	32
Totals	13440	5622	42

[1]Source: DFO Preliminary Final Quota Report, December 1998

[2]Source: DFO Website, data corresponds exactly to the assessment end of year (31 August) were not available.

Table 3. Pollock landings (t) by season and country for NAFO divs. 4VWX and Subdiv 5Zc.

Canada (Maritimes & Newfoundland)

	4VW				4X + 5Zc			
	Jan-Apr	May-Aug	Sept-Dec	Total	Jan-Apr	May-Aug	Sept-Dec	Total
1974	713	1257	807	2777	1643	11738	8817	22198
1975	1223	1005	1854	4082	1836	9866	10764	22466
1976	425	845	1186	2456	2078	12167	6864	21109
1977	931	1428	4748	7107	6010	5880	5656	17546
1978	3875	2696	510	7081	5835	7484	6401	19720
1979	1406	5477	1927	8810	4558	10023	6576	21157
1980	2493	4301	3633	10427	6353	13188	6018	25559
1981	4056	2437	11055	17548	5792	7170	9760	22722
1982	3030	4082	4774	11886	3096	14664	8383	26143
1983	2029	7099	1644	10772	4879	14212	2886	21977
1984	2288	4744	4217	11249	2820	13900	5496	22216
1985	3861	5031	5959	14851	6589	15673	6187	28449
1986	5522	8157	4534	18213	5859	14091	5086	25036
1987	6177	5521	4780	16478	5766	16496	6590	28852
1988	4744	5807	4397	14948	3761	15710	7412	26883
1989	4050	7538	4302	15890	6743	12471	6008	25222
1990	4752	4529	2913	12194	3126	13839	7019	23984
1991	4711	2144	3896	10751	6781	13746	6653	27180
1992	3153	2369	2586	8108	4566	13814	5514	23894
1993	809	1215	391	2415	4285	9433	4121	17839
1994	752	974	427	2152	1789	7923	3376	13088
1995	427	654	620	1701	1131	4271	2678	8080
1996	657	538	262	1457	1161	3952	2576	7689
1997	408	363	224	995	2184	5649	3099	10932
1998	180	450	1152	1782	3578	6419	2593	12590
1999	526	262		788	1008	3254		4262

USSR

	4VW				4X + 5Zc			
	Jan-Apr	May-Aug	Sept-Dec	Total	Jan-Apr	May-Aug	Sept-Dec	Total
1974	194	903	628	1725	11	512	53	576
1975	471	981	221	1673	58	149	124	331
1976	555	488	291	1334	10	58	64	132
1977	17	82		99	39	44		83
1978	9	459	8	476		26		26
1979	4	928		932	6	87		93
1980	122	715		837		113		113
1981	45	311		356	2			2
1982		297		297				0
1983	16	204		220		6		6
1984		97		97				0
1985		336		336				0
1986		564		564				0
1987		314		314				0
1988	96	958		1054				0
1989	605	1177		1782				0
1990	342	698		1040				0
1991	151	640	2	793		384		384
1992	519	350		869	2	135		137
1993	21	125		146		30		30
1994								
1995								
1996	6							
1997								
1998		1		1				
1999								

Table 3.(cont.) Pollock landings (t) by season and country for NAFO divs. 4VWX and Subdiv 5Zc.

Other Foreign Countries

	4VW				4X + 5Zc			
	Jan-Apr	May-Aug	Sept-Dec	Total	Jan-Apr	May-Aug	Sept-Dec	Total
1974	176	196	173	545	746	605	289	1640
1975	421	57	263	741	145	253	427	825
1976	254	318	162	734	288	237	888	1413
1977	10	194	19	223	168	304	52	524
1978	36	153	95	284	200	111	140	451
1979	22	22	54	98	118	136	138	392
1980	101	38	1	140	272	128	115	515
1981	90			90	410	269	254	933
1982	23	106		129	365	221	256	842
1983	18	268		286	358	497	472	1327
1984	87	83	1	171	387	528	776	1691
1985	82	70	8	160				0
1986	204	291	24	519				0
1987	110	311	32	453				0
1988	4	222		226				0
1989	99	1		100				0
1990	153	108		261				0
1991	209	169		378		118		118
1992	259	361		620	12	464		476
1993	33	213		246	4	343		347
1994		9		9		1		1
1995	11	43		54	1	3		4
1996	11	111		122			8	8
1997	17	29		46		18		18
1998	2	7		9				
1999	5	1		6				

Table 4. Nominal landings of pollock in Nafo Divs 4VWX and 5Zc for Canada(Maritimes,Quebec and Newfoundland).

Otter Trawlers – Tonnage Classes 4+

	4VW				4X + 5Zc			
	Jan-Apr	May-Aug	Sept-Dec	Total	Jan-Apr	May-Aug	Sept-Dec	Total
1970	1523	212	138	1873	686	1865	1581	4132
1971	629	63	208	900	919	3473	2073	6465
1972	417	90	545	1052	1461	5800	4138	11399
1973	726	276	2173	3175	3259	4227	3239	10725
1974	707	1113	628	2448	1057	6350	5964	13371
1975	1222	926	1776	3924	1042	5899	5361	12102
1976	424	737	1081	2242	877	5418	2746	9041
1977	912	1358	4545	6815	4846	1522	2661	9029
1978	3558	2107	377	6042	4676	3383	2411	10470
1979	1368	5194	1715	8277	3487	3421	1004	7912
1980	2448	3949	3412	9809	4321	3409	2411	10141
1981	3980	1382	9017	14379	4280	558	4956	9794
1982	2919	3084	4123	10126	1628	3917	3665	9210
1983	1879	6144	1032	9055	2890	2652	398	5938
1984	2155	3416	3559	9130	729	1833	564	2926
1985	3628	4339	5502	13469	581	835	879	2295
1986	4861	6499	3957	15317	1326	939	235	2500
1987	5609	4178	3998	13785	2435	2518	2408	7361
1988	3951	3588	4244	11783	755	3301	2951	7007
1989	3006	4933	3669	11608	1498	2489	2596	6583
1990	4154	2832	1836	8822	1654	1835	1268	4757
1991	4172	1393	2352	7917	1580	2638	1401	5619
1992	2794	1499	1025	5318	1306	2275	1288	4869
1993	718	311	224	1253	2629	651	1457	4737
1994	701	458	174	1333	177	757	860	1794
1995	381	463	417	1261	215	400	391	1006
1996	486	157	198	841	437	754	930	2121
1997	353	2	70	425	638	368	728	1734
1998	125	223	624	972	824	251	496	1571
1999	502	192		694	293	208		501

Otter Trawlers – Tonnage Classes 1 - 3

	4VW				4X + 5Zc			
	Jan-Apr	May-Aug	Sept-Dec	Total	Jan-Apr	May-Aug	Sept-Dec	Total
1970	8			8	338	2042	483	2861
1971	4			4	245	1708	717	2670
1972		9	1	10	537	2035	902	3474
1973			2	2	1922	6762	618	9302
1974		39	40	79	562	3398	591	4551
1975				0	745	2610	836	4191
1976				0	1039	2844	715	4598
1977		2		2	896	2224	808	3928
1978	9	23	2	34	955	2187	961	4103
1979		8	2	10	869	4043	1170	6082
1980	2	137	18	157	1523	4033	823	6379
1981	32	302	44	378	957	3178	1547	5682
1982	58	220	93	371	713	4775	1734	7222
1983	84	155	23	262	1403	6829	855	9087
1984	119	598	252	969	1847	8492	3015	13354
1985	197	151	89	437	5406	8564	1388	15358
1986	379	804	44	1227	3797	4801	594	9192
1987	504	311	73	888	2747	5859	483	9089
1988	556	708	13	1277	2739	6196	244	9179
1989	934	1296	60	2290	4533	2366	48	6947
1990	403	594	492	1489	533	3985	1996	6514
1991	319	80	642	1041	4379	5151	2049	11579
1992	236	149	997	1382	2645	6409	1378	10432
1993	29	100	8	137	1367	4290	1132	6789
1994	28	72	17	117	1378	2823	1079	5280
1995	39	26	8	73	701	2016	814	3531
1996	46	39	12	97	719	1439	1145	3303
1997	35	68	73	176	1424	2711	1320	5455
1998	22	24	504	550	2705	3248	1018	6971
1999	4	10		14	666	1568		2234

Table 4.(Cont.) Nominal landings of pollock in Nafo Divs 4VWX and 5Zc for Canada(Maritimes,Quebec and Newfoundland).

GILLNET, LONGLINE and MISCELLANEOUS Gears – all tonnage classes

	4VW				4X + 5Zc			
	Jan-Apr	May-Aug	Sept-Dec	Total	Jan-Apr	May-Aug	Sept-Dec	Total
1970		46	224	270	53	893	663	1609
1971		118	72	190	5	979	544	1528
1972		137	170	307	8	927	845	1790
1973	6	101	139	246	9	2196	1335	3540
1974	6	105	139	250	24	1990	2262	4276
1975	1	79	78	158	49	1557	4567	6173
1976	1	108	105	214	162	3908	3403	7473
1977	19	68	203	290	268	2134	2188	4590
1978	308	566	131	1005	204	1914	3029	5147
1979	38	275	210	523	202	2559	4402	7163
1980	43	215	203	461	509	5746	2784	9039
1981	44	753	1994	2791	555	3434	3257	7246
1982	53	778	558	1389	755	5972	2984	9711
1983	66	800	589	1455	586	4731	1635	6952
1984	14	730	406	1150	244	3775	1917	5936
1985	36	541	368	945	600	6274	3922	10796
1986	264	732	403	1399	716	8422	4202	13340
1987	69	1022	709	1800	589	8100	3696	12385
1988	80	1339	340	1759	260	6223	4230	10713
1989	110	1309	573	1992	712	7616	3364	11692
1990	196	1104	584	1884	939	8018	3755	12712
1991	221	671	902	1794	822	5958	3202	9982
1992	123	722	564	1409	616	5130	2849	8595
1993	62	804	159	1025	289	4492	1532	6313
1994	23	443	237	703	234	4343	1436	6013
1995	7	164	194	365	216	1855	1472	3543
1996	125	343	51	519	6	1758	501	2265
1997	20	293	81	394	123	2570	1051	3744
1998	34	202	24	260	49	2920	1079	4048
1999	20	59		79	49	1479		1528

Table 5. Reported landings by month and gear type in NAFO Divisions 4VWX5ZC. (from ZIF)

Gear	Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
Small Mobl	1989	735	1756	1117	1687	1292	2243	101	33	16	58	4	30	9272
	1990	342	357	157	157	424	1163	2094	897	478	843	836	338	8086
	1991	786	1074	647	2211	1270	1833	1580	568	781	728	827	355	12620
	1992	604	455	738	1082	2857	1084	1600	1215	556	507	783	529	11813
	1993	167	78	407	744	1048	1262	1429	680	381	148	338	274	6936
	1994	83	371	413	530	529	698	1219	454	276	313	286	238	5420
	1995	91	119	180	350	232	940	800	270	248	250	231	92	3605
	1996	188	155	211	230	335	385	415	343	284	325	322	227	3399
	1997	68	383	316	691	490	782	944	563	604	238	264	288	5631
	1998	290	644	1012	780	718	1117	1014	423	266	401	458	398	7521
	1999	137	87	227	219	282	407	538	371					2249
Large Mobl	1989	899	1056	1476	1058	1191	1794	2529	1847	1662	1175	2422	774	17881
	1990	837	1349	2690	959	898	1334	1349	1105	992	759	407	993	13668
	1991	1030	1617	1337	1800	1710	869	698	754	193	448	1483	1649	13589
	1992	1268	1012	768	1059	1488	1208	844	434	195	807	1091	220	10193
	1993	1144	867	858	482	243	624	20	75	89	42	863	686	5993
	1994	495	242	65	76	93	253	602	253	18	328	284	367	3105
	1995	283	224	49	40	121	268	348	129	87	105	423	194	2288
	1996	200	96	338	289	158	231	309	122	136	190	287	515	2962
	1997	234	311	313	132	116	99	82	81	162	155	277	203	2158
	1998	124	184	275	368	159	96	195	25	103	368	404	245	2544
	1999	232	117	185	281	124	90	105	79					1194
Gillnet	1989	7	1	182	385	548	1233	2494	2706	1962	801	395	55	10768
	1990	55	45	491	321	717	1202	2440	2272	2060	976	333	82	10993
	1991	39	66	249	394	501	860	1457	1474	1430	1161	480	148	8238
	1992	80	114	98	337	369	588	1168	1094	1093	661	353	89	6044
	1993	4	59	102	117	305	829	953	752	603	305	8	0	4037
	1994	0	7	5	136	201	632	821	622	526	252	53	8	3264
	1995				201	15	744	840	56	1298	133	41	5	3133
	1996				0	161	171	484	490	159	117	52	44	1678
	1997				117	152	454	597	654	497	320	99	18	2908
	1998			0	73	173	568	1113	623	569	277	89	18	3523
	1999			14	43	40	234	443	335					1110
Handline	1989	0	0	0	2	193	399	364	290	247	127	35	1	1658
	1990	10	6	30	66	86	458	471	586	346	156	22	3	2250
	1991	0	2		2	69	375	633	414	260	163	22	2	1942
	1992	3	0		0	18	339	625	445	313	223	38	8	2012
	1993		0		0	5	309	552	361	200	121	24	11	1583
	1994	0				28	482	419	249	170	87	26	5	1466
	1995				1	37	102	210	13	88	22	2		475
	1996					41	200	191	113	27	27	4	1	603
	1997				0	16	234	345	172	41	22	1	0	832
	1998					6	137	150	152	57	12	7		521
	1999					18	119	119	87					341
Longline	1989	9	15	5	13	69	114	213	242	186	91	35	18	1011
	1990	7	7	8	16	122	158	258	191	147	97	16	8	1035
	1991	46	15	4	18	68	150	285	311	197	163	33	10	1311
	1992	20	21	10	33	91	296	371	403	329	201	64	20	1858
	1993	4	11	13	30	118	280	400	392	248	115	50	7	1667
	1994	7	5	2	47	99	283	500	279	270	169	104	11	1776
	1995	12	0	1	7	23	45	77	49	35	31	9	3	293
	1996	2	0		18	24	28	75	84	56	41	12	9	351
	1997	1	6	2	15	12	34	63	109	73	50	7	3	396
	1998	2	2	1	5	6	25	71	66	44	21	5	3	242
	1999	3	1	4	4	14	31	52	44					152
Misc	1989	51	53	29	67	14	27	17	5	5	2	0	2	271
	1990	8	20	13	32	47	14	74	5	28	32	13	29	314
	1991	82	80	1	64	8	10	1	1	36	7	14	0	284
	1992	6	12	0	5	39	3	0	3	0	20		1	89
	1993	0	0	1	10	21	13	5	2		0	0	1	53
	1994	0	32	14	2	5	167	9	11	14	1	3	0	258
	1995	0	0		1	0	2	4	1	0	0	0	0	8
	1996	5	101	5	0	35	3	0	0	0	3	0	0	152
	1997		0	1	0	0	0	1					0	2
	1998		0				20	1	0	0				21
	1999						3	0	0					4
Total	1989	1702	2882	2809	3413	3305	5810	5718	5123	4078	2254	2891	880	40864
	1990	1260	1784	3389	1550	2292	4339	6885	5056	4051	2863	1827	1452	36348
	1991	1965	2834	2237	4489	3627	4107	4634	3522	2897	2670	2819	2163	37964
	1992	1982	1615	1612	2517	4862	3518	4408	3594	2486	2418	2329	866	32009
	1993	1319	1015	1381	1382	1740	3317	3359	2243	1521	731	1282	977	20267
	1994	585	657	500	800	956	2525	3568	1868	1274	1149	756	650	15288
	1995	387	343	229	599	428	2099	1880	519	1756	541	706	294	9781
	1996	375	352	554	537	754	1018	1567	1151	664	701	677	795	9145
	1997	304	700	633	955	787	1594	2052	1579	1377	786	649	511	11927
	1998	417	830	1288	1223	1063	1983	2544	1279	1059	1079	943	863	14371
	1999	373	205	409	548	457	884	1256	917					5049

Table 5. (Cont.) Reported landings by unit area and gear type in NAFO Divisions 4VW. (from ZIF)

		4VN	4VS	4Wf	4Wd	4We	4Wf	4Wg	4Wh	4Wj	4Wk	4Wl	4Wm	4Wu	Total
Small Mobile	1989	323	679	20	12	62		44	103	200	411	249	6	181	2290
	1990	176	297	41	6	13		2	83	57	592	152		125	1544
	1991	55	43	5	0	0		1	67	1	633	230	4	0	1040
	1992	30	56	1	0	3		9	77	3	555	601	44	4	1382
	1993	31	96			0		4	1		14	1			147
	1994	69	33	D		0		1	7		29	2			140
	1995	20	22					0			8	24	0		74
	1996	3	1		0	0	0	0	0	0	87	4	1		97
	1997	8	3		0			1	1	0	133	30	0		176
	1998	13	1		0				3	0	22	510			550
	1999	0	1						1		3	9	0	0	15
Large Mobile	1989	4052	6192	4		0		265	76	1	569	378		0	11536
	1990	1892	5468	3		0		721	13	134	126	445	46	0	9850
	1991	963	2866	2	4	0		2134	5	1	306	1538	101	30	7950
	1992	247	2050	8	1	4		967	17	26	105	1870		29	5324
	1993	52	474					110	0		371	249			1256
	1994	360	273	0				68	0	2	554	54			1311
	1995	373	533				0	107		1	73	149	5		1261
	1996	26	228					8	4		552	23			841
	1997	2	19			0		1			396	8			425
	1998	141	115					36		1	81	598			972
	1999	26	367					80	0	1	21	200			694
Gillnet	1989	10	184	2	117	3			74	39	217	294		62	1003
	1990	7	3		23			45	20	84	246	462		127	1016
	1991	6			152	0			33	372	148	394	0	18	1125
	1992				30					65	154	152		56	457
	1993				4	213			1	0	83	13		0	314
	1994		8			69					33	3			114
	1995	0	74		36				28		35	9		100	283
	1996		24		27				11		36	21		17	135
	1997	0	86		3	1			67		13	13		39	243
	1998	1	45		10	16			55		28	48	1	15	219
	1999		3						27		22	6		0	58
Handline	1989	7	264		32	0					21	3		22	350
	1990	2	59		12				30		83	14		62	262
	1991	2	3		12	3				7	8	6		0	42
	1992	2	0		6				2		108	13		4	135
	1993	0	0		0						36			2	38
	1994	0			2						10			1	14
	1995		11			3			1		1	0	0	7	23
	1996		44		8				12		5	5		27	102
	1997		22								17	2		8	49
	1998		8		0				5		0			1	15
	1999		2												2
Longline	1989	19	185	1	91	13		0		30	176	7		42	548
	1990	13	219	6	50	4		1	11	24	114	17		28	487
	1991	9	66	0	23	38		0	26	97	220	60	0	24	563
	1992	1	11	3	112	91		0	3	67	126	59	0	294	766
	1993	0	129	1	77	256		1	3	5	84	10	1	61	628
	1994	2	11	0	17	364	0		3	2	159	1		5	565
	1995	0	4			0	0	0	2	0	13	6	0	28	56
	1996	1	1		0	0		1	17	0	67	13	0	37	136
	1997	0	5		4	0	0	0	5	0	47	13	0	25	101
	1998	0	2		0	0	0	0	0	0	17	3	0	3	26
	1999	0	1		0	0			0	0	11	4	0	3	20
Misc	1989	54	57	3	0			3		2	0			0	120
	1990	33	19	29		4			4	1	10	2		8	110
	1991	10	30			0		11	0	0	12	0			64
	1992	5	12	0				13	3	0	17	0		0	51
	1993	2	43			0			0						45
	1994	6	3								2				11
	1995	4	0												4
	1996	0	134					9			0	2			146
	1997	0	1								1				1
	1998	0	0									0			0
	1999														0
Total	1989	4465	7541	30	253	79		313	253	272	1394	931	6	309	15845
	1990	2124	6065	80	90	20		789	160	300	1172	1093	46	350	12270
	1991	1043	3009	7	193	42		2148	132	477	1329	2229	106	72	10784
	1992	284	2129	13	149	98		990	101	162	1064	2695	44	387	8114
	1993	86	743	1	81	470		114	6	5	588	272	1	63	2429
	1994	437	329	0	19	434	0	69	11	4	787	60		6	2155
	1995	397	665		36	3	0	108	31	1	130	188	6	135	1701
	1996	30	432		35	0	0	19	44	0	747	67	1	81	1457
	1997	10	135		7	1	0	1	94	0	606	66	1	73	995
	1998	155	171		11	16	0	36	63	2	149	1160	1	20	1782
	1999	26	374		0	0		80	28	1	56	219	0	3	788
Grand Total		9058.984	21503.81	129.625	874.100	1181.922	0.254	4843.645	921.175	1223.678	8021.307	8679.792	211.717	1498.225	58317.33

Table 5. (Cont.) Reported landings by unit area and gear type in NAFO Divisions 4X5Zc. (from ZIF)

		4Xl	4Xm	4Xn	4Xo	4Xp	4Xq	4Xr	4Xs	4Xu	5Y	5Ze	Total
Small Mobile	1989		102	1852	744	1273	1105	37	26	1663	53	128	6983
	1990	7	55	732	855	312	1811	264	83	1632	79	912	6543
	1991		120	2782	1593	1381	1999	1595	1109	157	148	695	11580
	1992		437	3059	1409	820	1595	1428	1010	20	142	510	10431
	1993		51	1628	855	909	1267	916	587	14	147	416	6789
	1994		14	956	492	458	720	788	566	3	73	1210	5280
	1995		103	364	119	381	1410	449	289	6	140	289	3531
	1996		104	393	112	503	971	400	303	8	167	342	3302
	1997		70	564	133	595	2389	723	410	1	120	452	5456
	1998		37	1435	29	2142	1805	272	359	1	229	661	6971
	1999		20	343	12	448	629	391	196	0	39	155	2234
Large Mobile	1989		55	2678	127	2078	608			77	2	721	6345
	1990		10	1772	205	2112	223	1		73		422	4818
	1991		71	1636	915	2219	189	2	6	113		456	5619
	1992		23	1701	524	661	333	60	48	17	1	1504	4869
	1993		52	672	400	614	2		0	121		2876	4737
	1994		32	59	98	376	106	17		4	19	1082	1795
	1995		43	12	16	326	370	1		0	14	222	1006
	1996		50	338	18	748	293	0	2	2	1	671	2121
	1997	15	21	49	7	545	662	1	1		0	433	1733
	1998		4	244	0	796	66	0	0		2	459	1571
	1999		2	153		151	95					99	500
Gillnet	1989		3730	1107	2144		443		196	1235	461	449	9766
	1990		2696	1335	2094	83	581	155	268	2213	258	315	9977
	1991		2428	645	1268	20	242	281	803	914	300	395	7114
	1992		1046	514	1318	17	375	226	427	738	299	627	5586
	1993	13	382	143	670	359	606	333	193	174	221	628	3722
	1994		174	12	429	184	166	360	110	811	130	796	3151
	1995		27	156	156	411	737	219	95	511	93	446	2850
	1996		101	118	138	200	437	160	63	112	88	126	1543
	1997		180	116	113	369	837	178	103	328	182	259	2666
	1998		159	54	242	467	1138	171	85	109	195	884	3305
	1999		76	25	73	92	346	99	44	16	64	216	1052
Handline	1989		183	21	480	7	113	214	150	109	14	38	1309
	1990		100		525		267	578	337	160	8	12	1988
	1991		48		849	0	176	511	371	109	12	23	1900
	1992		44	7	588	0	253	412	304	168	2	100	1877
	1993		110	1	522	45	313	291	194	29	0	38	1545
	1994		221	1	489	41	181	234	181	77	13	15	1453
	1995		22	1	100	15	10	5	26	263	1	9	452
	1996		25	2	106	10	100	116	43	86	9	26	502
	1997		18	2	146	35	128	186	92	146	10	22	782
	1998		32	2	112	33	108	113	24	53	6	24	507
	1999		28	8	97	20	63	41	38	20	18	7	339
Longline	1989		126	11	80	16	63	80	2	42	0	45	465
	1990		145	10	160	11	36	41	4	63		78	548
	1991		159	20	174	40	26	74	14	109	0	132	748
	1992		45	42	333	29	70	49	6	224	0	294	1092
	1993		138	119	306	58	38	65	7	72	1	235	1036
	1994		249	101	352	58	16	45	9	168		212	1210
	1995		25	58	38	24	25	1	2	26	0	37	237
	1996		26	45	47	17	10	9	1	28		34	215
	1997	0	19	40	48	31	14	24	2	51	0	65	296
	1998	0	28	31	54	37	16	7	1	13	1	29	215
	1999	0	19	18	28	28	6	8	0	2	1	22	132
Misc	1989		44	21	63		1	1		18		5	152
	1990		71	36	29	5	54	4	0	2		1	204
	1991		0	88	2	84	34	0	2	6		4	220
	1992		1	34	2				0			1	38
	1993		6	0	0		0		1				8
	1994		188	0	0	0	23	8	1	12		12	244
	1995		0	0	0	1		0	1	2	1		4
	1996		1	3	1	0						2	6
	1997		0	0	0	0	1						1
	1998		0		0		1					20	21
	1999				0	0	0	3					4
Total	1989		4239	5689	3819	3373	2334	332	374	3144	531	1385	25019
	1990	7	3078	3866	3868	2523	2953	1042	693	4142	346	1740	24078
	1991		2824	5172	4821	3745	2685	2465	2105	1408	461	1715	27180
	1992		1594	5357	4174	1528	2626	2175	1793	1167	444	3036	23894
	1993	13	739	2563	2754	1985	2226	1605	982	409	368	4193	17839
	1994		878	1128	1860	1097	1213	1453	868	1074	236	3327	13133
	1995		220	592	429	1158	2552	676	393	808	250	1004	8081
	1996		305	898	419	1478	1811	686	412	215	265	1200	7689
	1997	15	305	770	446	1574	4030	1112	607	527	314	1231	10932
	1998	0	257	1767	437	3495	3134	564	469	177	433	1857	12590
	1999	0	148	547	209	739	1139	543	278	39	122	499	4262
Grand Total		35.455	14585.4	26369.99	22635.83	22594.45	26883.58	12652.59	8970.177	13111.06	3789.319	21188.92	174868.771

Table 6. Summary of fishermen's views on the status of the pollock fishery in 1999, organized by gear sector.

Sector	Area Fished	Comments
Mobile <65' (one fleet manager)	Primarily Western and Central 4X	Generally poor fishery, but some positive catches made in eastern 4X. The fishery distribution is the opposite of what has been seen for the past several years (ie. Pollock now scarce in western 4X).
Mobile <65' (five skippers)	Western 4X	Unanimous that the fishery was very poor, pollock not found in the traditional locations in the lower Bay of Fundy.
Mobile 65-100' (one fleet manager)	Throughout Management Unit	Poor fishery in 1999 compared with 1998 (particularly late '98). Small fish, not retained in bottom trawls. Feels quota has been not restrictive enough in 1998.
Mobile >100' (one skipper, one fleet manager)	Throughout Management Unit	Although fishery started slowly, there are now sufficient fish of the size required by the market. Does not anticipate reaching quota. Good fishing areas have included Emerald Basin, eastern Georges Bank and the Scotian Shelf edge.
Handline (one representative	Eastern Bay of Fundy	Insufficient fishery this year for comments to be made.
Longline (one representative	Central/Western 4X	Pollock not a major concern for this gear but anomolously high catches of pollock by longline have been noted in the recent past. This was not observed in 1999.
Gillnet (one skipper)	4W	Excellent fishery this year in Emerald Basin, and in area east of Sambro Basin. Good size range of fish, but few really big fish. Abundance of small (14" fish) noted in the water. Best fishery in past 6-7 years.
Gillnet (eight skippers)	Eastern 4X (inshore)	Best fishery in the past 6-7 years, generally close to the 4W line. Good range of sizes, but few really large fish. Lots of harbour pollock around. Big improvement from last year.
Gillnet (two skippers)	Central 4X	Generally poor fishing, small fish. Lots of small fish not retained by gillnet.
Gillnet (one skipper)	Western 4X	Fishery was poor, but when pollock seen, there were a good range of sizes. Had to work hard to catch pollock this year.
Gillnet (one skipper)	Mouth of the Bay of Fundy	Catch dominated by cod. Not too many huge pollock, except September. There were plenty of pollock right through our limited fishery. Most common size 28".
Gillnet (one skipper speaking of experiences of three boats	Georges	Fishery in 1999 started slowly, problems with "jelly" on the nets made them more visible to fish. Fish small. In August and September, fishery improved considerable. Good size range of fish noted.

Table7. Catch at age for pollock in 4VWX5Zc (numbers in thousands)

Total Catch at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	-	-	-	-	-	8	-	10	-	1
2	197	175	178	36	23	98	171	171	134	56
3	5603	1058	1361	1476	835	2763	291	291	4018	1999
4	2662	4023	1974	2873	3119	5786	1864	1864	1589	9514
5	2356	2090	3649	1785	3084	3482	5306	5306	563	1256
6	1088	1904	1089	2181	1276	1705	3169	3169	1873	238
7	317	835	1089	732	1167	528	1075	1075	2295	524
8	164	196	207	417	257	249	277	277	1069	835
9	80	55	36	108	143	47	168	168	389	428
10	83	57	14	19	17	15	32	32	172	163
11	74	35	18	25	19	14	9	9	87	50
12	40	31	49	80	18	-	2	2	22	58

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	1	1	1	-	1	-	8	-	-	-
2	87	19	59	15	11	61	49	329	53	58
3	803	459	705	411	648	670	803	1783	2895	923
4	3493	2028	2889	1986	2563	4104	1777	3054	5265	3784
5	7155	3830	3550	4326	3170	3832	3596	2890	3168	2954
6	639	5022	3440	3577	3158	2424	2727	3486	1933	1337
7	92	1162	2790	2587	1884	2170	1563	1607	1058	506
8	217	150	342	1744	1158	970	986	803	435	275
9	210	179	94	247	1006	702	641	402	308	101
10	92	233	109	44	53	434	308	291	169	37
11	18	126	150	48	20	31	120	142	67	21
12	23	41	68	47	32	14	47	88	54	13

	1994	1995	1996	1997	1998	1999
1	-	-	-	-		
2	50	32	95	7	15	1
3	273	467	430	243	594	60
4	693	795	1366	1188	1755	579
5	2184	1256	1117	2052	1920	833
6	1396	1236	793	1058	1606	490
7	709	401	446	301	402	232
8	338	96	84	61	75	35
9	172	37	21	4	25	9
10	44	17	4	0	4	1
11	18	5	1	1	2	2
12	7	1	1	0	0	

Table7 (Cont). Catch at age for pollock in 4VWX5Zc (numbers in thousands)

Canadian Catch at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	-	-	-	-	-	-	-	-	-	-
2	185	187	126	36	23	8	128	42	132	54
3	4784	986	1207	1433	786	98	244	1333	3516	1857
4	2364	3567	1738	2855	3070	2752	1733	672	1584	9309
5	2125	1852	3170	1760	3022	5582	5035	2043	583	1248
6	954	1660	939	2128	1222	3341	3113	4019	1872	237
7	273	795	1001	710	1142	1645	1047	2432	2294	523
8	144	132	194	395	246	495	269	712	1067	833
9	64	45	35	90	134	248	165	207	389	428
10	51	56	12	19	17	47	32	148	172	183
11	33	34	16	25	19	15	9	31	87	50
12	10	30	42	80	18	14	2	24	22	58

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	-	-	-	-	-	-	-	-	-	-	-
2	22	6	3	13	11	34	4	45	24	56	50
3	720	443	387	372	583	580	595	1024	2008	901	272
4	3491	2017	2695	1958	2387	3424	1578	2571	4508	3521	691
5	7152	3796	3507	4277	3115	3652	3276	2774	3041	2824	2179
6	639	5017	3420	3528	3113	2381	2662	3427	1853	1282	1395
7	91	1159	2775	2555	1808	2104	1543	1592	1036	498	709
8	215	145	341	1680	1121	931	970	793	427	271	338
9	207	174	94	245	992	677	631	390	306	100	172
10	148	224	105	40	53	414	308	288	167	37	44
11	31	119	144	44	18	28	118	138	66	21	18
12	24	39	65	44	28	10	41	87	53	13	7

	1995	1996	1997	1998	1999	1989-1998
1			0			-
2	23	20	6	14	1	28
3	407	268	219	590	59	686
4	781	1271	1157	1746	575	2125
5	1251	1067	2039	1919	831	2402
6	1235	769	1057	1606	490	1767
7	401	437	300	402	232	902
8	96	83	61	75	35	405
9	37	21	4	25	9	236
10	17	4	0	4	1	128
11	5	1	1	2	2	40
12	1	1	0	0		21

Table7 (Cont). Catch at age for pollock in 4VWX5Zc (numbers in thousands)

Foreign Catch at Age

	1974	1975	1976	1977-1993
1	-	-	-	-
2	12	8	17	-
3	291	67	121	-
4	162	228	160	-
5	152	87	237	-
6	77	78	64	-
7	20	23	42	-
8	9	4	14	-
9	5	2	2	-
10	3	1	2	-
11	3	1	2	-
12	1	1	8	-

Small Mesh Gear Catch at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	-	-	-	-	-	-	-	10	-	-
2	-	-	35	-	-	-	43	829	2	2
3	528	6	33	43	49	11	47	1	502	142
4	136	229	77	18	49	104	131	1	5	205
5	79	151	242	25	62	141	271	1	-	8
6	57	166	86	53	54	60	56	-	1	1
7	24	17	48	22	25	33	28	-	1	1
8	10	60	-	22	11	1	8	1	2	2
9	10	9	-	18	9	-	3	1	-	-
10	29	-	-	-	-	-	-	-	-	-
11	38	-	-	-	-	-	-	-	-	-
12	29	-	-	-	-	-	-	-	-	-

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	1	1	1	-	1	-	8	-	-	-
2	65	13	56	2	-	27	45	284	29	2
3	83	16	318	39	65	90	208	739	887	22
4	2	11	194	28	176	680	199	483	757	263
5	3	34	43	49	55	180	322	116	127	130
6	-	5	20	49	45	43	65	59	80	55
7	1	3	15	32	76	66	20	15	22	8
8	2	5	1	64	35	39	18	10	8	4
9	3	5	-	2	14	25	10	12	2	1
10	-	9	4	4	-	20	-	3	2	-
11	0	7	6	4	2	3	2	4	1	-
12	2	2	3	3	4	4	6	1	1	-

	1994	1995	1996	1997	1998	1999
1	-					
2	-	9	75	2		
3	1	60	165	25	4	2
4	2	14	95	31	8	3
5	5	5	50	13	1	2
6	1	1	24	1		
7	-		9			
8	-		1			
9	-					
10	-					
11	-					
12	-					

Table 8. Mean weights at age (kg) for pollock in 4VWX5Zc.

Total Weight at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	-	-	-	-	-	0.19	-	-	-	0.63
2	0.82	0.86	0.59	0.79	1.14	0.77	1.03	0.68	0.76	0.83
3	1.38	1.26	1.21	1.10	1.23	1.18	1.68	1.74	1.19	1.25
4	1.94	1.95	1.92	1.52	1.80	1.55	2.08	2.54	2.69	1.66
5	3.00	3.06	2.81	2.48	2.60	2.62	2.77	2.91	3.51	3.12
6	4.09	3.81	3.71	3.50	3.90	3.40	3.46	3.34	4.18	4.12
7	5.08	5.06	4.67	4.52	4.59	4.34	4.12	4.32	4.45	4.83
8	6.16	6.52	5.64	5.47	6.02	5.55	5.58	5.93	5.19	5.08
9	6.68	7.49	7.02	6.62	6.91	6.61	6.50	6.90	6.12	5.84
10	7.39	7.49	7.80	7.25	7.37	7.14	9.07	7.77	7.64	8.48
11	8.58	8.22	8.76	10.02	8.38	8.79	8.40	7.54	8.00	8.00
12	10.03	9.59	9.11	11.30	10.03	-	11.65	9.22	8.65	8.72

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0.36	0.00	0.00	0.00	0.00	0.00	0.25	0.14	0.00	0.00
2	0.73	0.59	0.35	0.92	1.19	0.60	0.48	0.53	0.75	0.97
3	1.64	1.58	1.18	1.44	1.31	1.23	1.30	1.09	1.08	1.19
4	2.36	2.22	2.12	2.04	1.96	1.71	2.04	1.93	1.62	1.54
5	2.67	3.02	2.73	2.60	2.71	2.43	2.56	2.63	2.41	2.17
6	3.84	3.39	3.48	3.07	3.29	3.16	2.96	3.07	3.03	2.95
7	5.41	3.72	3.85	3.70	3.60	3.69	3.78	3.42	3.49	3.33
8	5.97	4.85	4.41	4.05	4.39	4.03	4.21	4.16	4.18	3.88
9	5.90	6.61	6.00	4.45	4.61	4.68	4.97	4.63	4.96	4.70
10	6.32	6.55	6.60	6.25	5.74	4.79	5.24	5.00	5.60	5.35
11	7.69	7.25	6.76	6.48	7.53	6.41	6.06	5.77	5.88	5.97
12	8.53	8.81	6.69	7.17	8.51	7.25	7.10	5.90	6.43	6.81

	1994	1995	1996	1997	1998	1999
1	-			0.10		
2	0.87	0.61	0.38	0.81	0.87	0.59
3	1.28	1.07	1.02	1.21	1.12	1.09
4	1.54	1.65	1.66	1.80	1.55	1.50
5	1.90	2.08	2.12	2.34	2.17	1.88
6	3.06	2.58	2.68	3.11	2.94	2.83
7	3.78	3.64	3.18	3.69	3.89	3.96
8	4.18	4.35	4.56	4.91	4.70	4.98
9	4.74	4.66	4.94	7.57	4.94	5.28
10	5.59	4.88	7.44	8.88	6.96	8.45
11	6.00	5.51	9.64	6.93	8.42	9.22
12	8.18	7.57	6.83	11.75	11.97	

Table 8 (Cont.). Mean weights at age (kg) for pollock in 4VWX5Zc.

Canadian Weight at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	-	-	-	-	-	0.19	-	-	-	-
2	0.83	0.86	0.63	0.79	1.14	0.77	1.12	1.01	0.76	0.84
3	1.43	1.27	1.23	1.11	1.26	1.18	1.77	1.74	1.24	1.25
4	1.98	1.99	1.94	1.52	1.81	1.54	2.10	2.54	2.70	1.67
5	3.02	3.10	2.80	2.48	2.59	2.63	2.80	2.91	3.51	3.13
6	4.05	3.87	3.73	3.49	3.88	3.38	3.47	3.34	4.18	4.11
7	5.03	5.07	4.65	4.50	4.59	4.33	4.14	4.32	4.45	4.83
8	6.06	6.51	5.62	5.45	6.00	5.54	5.56	5.93	5.19	5.08
9	6.62	7.47	7.04	6.55	6.84	6.61	6.51	6.90	6.12	5.84
10	7.22	7.69	7.71	7.25	7.37	7.14	9.07	7.77	7.64	6.48
11	8.12	8.47	8.67	10.02	8.38	8.79	8.40	7.54	8.00	8.00
12	9.37	9.89	9.19	11.30	10.03	-	11.65	9.22	8.65	8.72

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	-					-		-	-	-
2	1.46	1.08	0.91	1.01	1.19	0.75	0.82	0.88	1.10	0.99
3	1.68	1.61	1.43	1.51	1.40	1.26	1.45	1.30	1.26	1.20
4	2.36	2.22	2.15	2.05	2.01	1.82	2.06	2.06	1.69	1.56
5	2.67	3.03	2.73	2.60	2.72	2.45	2.55	2.67	2.43	2.19
6	3.84	3.39	3.48	3.07	3.30	3.17	2.97	3.08	3.06	2.97
7	5.41	3.72	3.86	3.71	3.61	3.71	3.78	3.42	3.51	3.33
8	5.97	4.87	4.42	4.07	4.39	4.05	4.22	4.16	4.20	3.88
9	5.90	6.64	6.00	4.44	4.62	4.71	4.98	4.63	4.96	4.70
10	6.34	6.60	6.62	6.31	5.74	4.81	5.24	4.99	5.61	5.35
11	7.69	7.33	6.79	6.63	8.36	6.64	6.05	5.77	5.88	5.97
12	8.76	8.93	7.00	7.26	8.72	7.25	7.19	5.87	6.42	6.81

	1994	1995	1996	1997	1998	1999
1	-					
2	0.87	0.73	1.02	0.98	0.88	0.63
3	1.29	1.14	1.34	1.28	1.12	1.11
4	1.54	1.66	1.69	1.83	1.55	1.50
5	1.90	2.09	2.14	2.34	2.17	1.88
6	3.07	2.58	2.69	3.12	2.94	2.83
7	3.78	3.64	3.20	3.70	3.89	3.98
8	4.18	4.35	4.58	4.91	4.70	4.98
9	4.74	4.66	4.96	7.57	4.94	5.28
10	5.59	4.88	7.44	8.88	6.96	8.45
11	6.00	5.51	9.64	6.92	8.42	9.22
12	6.18	7.57	6.83	11.75	11.97	

Table 8 (Cont.). Mean weights at age (kg) for pollock in 4VWX5Zc.

Foreign Fishery Weight at Age

	1974	1975	1976	1977-93
1	-	-	-	-
2	0.59	0.84	0.63	-
3	1.24	1.13	1.04	-
4	1.81	1.68	1.88	-
5	2.89	2.32	2.83	-
6	3.97	3.25	3.52	-
7	5.23	4.33	4.83	-
8	6.70	5.13	5.90	-
9	6.72	5.13	6.70	-
10	7.00	-	8.26	-
11	8.43	-	9.46	-
12	13.00	-	8.68	-

Small Mesh Gear Weight at Age

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	0.77	0.68	0.62	0.43
3	1.02	1.11	0.92	0.74	0.83	1.23	1.25	1.52	0.84	1.15
4	1.47	1.74	1.45	1.65	1.66	1.81	1.86	1.74	2.15	1.28
5	2.71	3.04	2.91	2.80	2.88	2.49	2.19	2.96	-	2.52
6	4.90	3.47	3.68	3.90	4.32	3.93	2.72	3.63	3.54	4.38
7	5.50	5.62	5.13	4.99	4.45	4.48	3.14	4.28	4.97	4.62
8	7.01	6.64	-	5.90	6.45	5.98	6.32	5.41	5.30	4.35
9	7.01	8.00	-	6.92	8.01	-	6.37	7.36	8.82	5.03
10	7.73	-	-	-	-	-	-	8.87	7.43	7.08
11	8.99	-	-	-	-	-	-	-	-	7.81
12	10.20	-	-	-	-	-	-	-	8.50	8.39

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0.36	-	-	-	-	-	0.25	0.14	-	-
2	0.48	0.37	0.32	0.32	0.26	0.42	0.45	0.47	0.46	0.50
3	1.29	0.82	0.87	0.79	0.50	1.08	0.86	0.79	0.70	1.00
4	2.50	1.39	1.68	1.40	1.22	1.19	1.85	1.29	1.23	1.35
5	2.82	2.35	2.48	1.92	2.39	2.04	2.59	1.85	1.90	1.93
6	3.77	2.92	3.24	2.65	2.70	2.82	2.80	2.69	2.16	2.59
7	4.97	3.04	3.20	2.94	3.36	3.08	3.68	3.40	2.77	3.35
8	5.60	4.29	3.85	3.61	4.33	3.89	3.77	3.89	3.48	3.95
9	5.87	5.40	-	4.78	4.30	3.99	4.32	4.54	4.31	5.10
10	5.96	5.35	6.14	5.74	-	4.45	5.74	6.02	4.60	6.10
11	7.25	5.94	6.04	4.84	-	4.19	6.12	5.86	5.85	6.80
12	6.19	6.46	-	5.96	7.04	7.24	6.45	8.25	6.80	7.80

	1994	1995	1996	1997	1998	1999
1				0.10		
2	0.36	0.29	0.21	0.27	0.25	0.24
3	0.60	0.58	0.51	0.59	0.63	0.45
4	0.76	0.80	1.26	0.91	0.80	0.91
5	1.24	1.22	1.79	1.38	1.17	1.16
6	1.67	1.94	2.17	1.93	1.91	1.83
7	-		2.29	2.26	1.91	2.24
8	-		2.83	4.10		2.55
9	-		3.06			2.95
10	-					
11	-					
12	-					

M121

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Table 9. Proportional Catch at Age for pollock in 4VWX5Zc.

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.08	0.00	0.01
2	1.56	1.67	1.84	0.37	0.23	[redacted]	1.38	1.38	1.10	0.37
3	44.24	10.12	14.08	15.17	8.39	18.80	[redacted]	2.35	[redacted]	13.22
4	21.02	38.46	20.43	29.52	31.32	39.37	15.08	[redacted]	13.01	[redacted]
5	18.60	19.98	37.76	18.34	30.97	23.70	42.91	42.86	[redacted]	8.31
6	8.59	18.20	11.27	22.41	12.81	11.60	25.63	25.61	15.34	[redacted]
7	2.50	7.98	11.27	7.52	11.72	3.59	8.69	8.69	18.79	3.47
8	1.30	1.87	2.14	4.28	2.58	1.69	2.24	2.24	8.75	5.52
9	0.63	0.53	0.37	1.11	1.44	0.32	1.36	1.36	3.19	2.83
10	0.66	0.54	0.14	0.20	0.17	0.10	0.26	0.26	1.41	1.08
11	0.58	0.33	0.19	0.26	0.19	0.10	0.07	0.07	0.71	0.33
12	0.32	0.30	0.51	0.82	0.18	0.00	0.02	0.02	0.18	0.38

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0.01	0.01	0.01	0.00	0.01	0.00	0.06	0.00	0.00	
2	0.68	0.14	0.42	0.10	0.08	0.40	0.39	2.21	0.34	0.58
3	6.26	3.46	4.97	2.73	4.73	4.35	6.36	11.87	[redacted]	9.22
4	27.23	15.31	20.35	13.21	18.71	26.63	14.07	20.56	34.18	[redacted]
5	[redacted]	28.91	25.01	28.78	23.14	24.86	28.49	19.45	20.56	29.51
6	4.96	[redacted]	24.23	23.80	23.05	15.73	21.60	23.47	12.55	13.36
7	[redacted]	8.77	[redacted]	17.21	13.75	14.08	12.38	10.82	6.87	5.08
8	1.69	[redacted]	2.41	[redacted]	8.44	6.29	7.81	5.41	2.82	2.75
9	1.64	1.35	[redacted]	1.64	[redacted]	4.55	5.06	2.71	2.00	1.01
10	0.72	1.76	0.77	[redacted]	0.39	[redacted]	2.44	1.96	1.10	0.37
11	0.14	0.95	1.06	0.32	[redacted]	0.20	[redacted]	0.96	0.43	0.21
12	0.18	0.31	0.48	0.31	0.23	[redacted]	0.37	0.59	0.35	0.13

	1994	1995	1996	1997	1998	1999
1	0.00	0.00	0.00			
2	0.85	0.74	2.18	0.15	0.23	0.04
3	4.64	[redacted]	9.87	4.96	9.28	2.51
4	11.78	18.31	[redacted]	24.17	27.43	25.86
5	[redacted]	28.92	25.63	[redacted]	30.01	37.38
6	23.73	[redacted]	18.20	21.53	[redacted]	21.89
7	12.05	9.23	[redacted]	6.11	6.28	[redacted]
8	5.74	2.21	1.93	[redacted]	1.18	1.52
9	2.92	0.85	0.48	0.09	0.39	0.41
10	0.75	0.39	0.09	0.01	0.06	0.07
11	0.31	0.12	0.02	0.02	0.02	0.08
12	0.12	0.02	0.02	0.00	0.00	0.02

Table 9. Proportional Catch at Age for pollock in 4VWX5Zc.

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.08	0.00	0.01
2	1.56	1.67	1.84	0.37	0.23	[illegible]	1.38	1.38	1.10	0.37
3	44.24	10.12	14.08	15.17	8.39	18.80	[illegible]	2.35	[illegible]	13.22
4	21.02	38.46	20.43	29.52	31.32	39.37	15.08	[illegible]	13.01	[illegible]
5	18.60	19.98	37.76	18.34	30.97	23.70	42.91	42.88	[illegible]	8.31
6	8.59	18.20	11.27	22.41	12.81	11.60	25.63	25.61	15.34	[illegible]
7	2.50	7.98	11.27	7.52	11.72	3.59	8.69	8.69	18.79	3.47
8	1.30	1.87	2.14	4.28	2.58	1.69	2.24	2.24	8.75	5.52
9	0.63	0.53	0.37	1.11	1.44	0.32	1.36	1.36	3.19	2.83
10	0.66	0.54	0.14	0.20	0.17	0.10	0.26	0.26	1.41	1.08
11	0.58	0.33	0.19	0.26	0.19	0.10	0.07	0.07	0.71	0.33
12	0.32	0.30	0.51	0.82	0.18	0.00	0.02	0.02	0.18	0.38

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0.01	0.01	0.01	0.00	0.01	0.00	0.06	0.00	0.00	
2	0.68	0.14	0.42	0.10	0.08	0.40	0.39	2.21	0.34	0.58
3	6.26	3.46	4.97	2.73	4.73	4.35	6.36	11.87	[illegible]	9.22
4	27.23	15.31	20.35	13.21	18.71	26.63	14.07	20.58	34.18	[illegible]
5	[illegible]	28.91	25.01	28.78	23.14	24.86	28.49	19.45	20.56	29.51
6	4.98	[illegible]	24.23	23.80	23.05	15.73	21.60	23.47	12.55	13.36
7	[illegible]	8.77	[illegible]	17.21	13.75	14.08	12.38	10.82	6.87	5.06
8	1.69	[illegible]	2.41	[illegible]	8.44	6.29	7.81	5.41	2.82	2.75
9	1.64	1.35	[illegible]	1.64	[illegible]	4.55	5.08	2.71	2.00	1.01
10	0.72	1.76	0.77	[illegible]	0.39	[illegible]	2.44	1.96	1.10	0.37
11	0.14	0.95	1.06	0.32	[illegible]	0.20	[illegible]	0.96	0.43	0.21
12	0.18	0.31	0.48	0.31	0.23	[illegible]	0.37	0.59	0.35	0.13

	1994	1995	1996	1997	1998	1999
1	0.00	0.00	0.00			
2	0.85	0.74	2.18	0.15	0.23	0.04
3	4.64	[illegible]	9.87	4.95	9.28	2.51
4	11.78	18.31	[illegible]	24.17	27.43	25.86
5	[illegible]	28.92	25.63	[illegible]	30.01	37.38
6	23.73	[illegible]	18.20	21.53	[illegible]	21.89
7	12.05	9.23	[illegible]	6.11	6.28	[illegible]
8	5.74	2.21	1.93	[illegible]	1.18	1.52
9	2.92	0.85	0.48	0.09	0.39	0.41
10	0.75	0.39	0.09	0.01	0.06	0.07
11	0.31	0.12	0.02	0.02	0.02	0.08
12	0.12	0.02	0.02	0.00	0.00	0.02

Table 10 Age disaggregated catch rates for otter trawlers TC 1-3 fishing pollock in 4X5, Stronger than average year classes (1979, 1989, 1992) are indicated in grey.

	1982	1983	1984	1985	1986	1987	1988	1989
3	[illegible]	0.1040	0.0356	0.0125	0.0227	0.0145	0.0105	
4	0.0743	[illegible]	0.1562	0.0486	0.0928	0.0572	0.0523	
5	0.0186	0.0446	[illegible]	0.1376	0.0897	0.0999	0.0743	
6	0.0457	0.0050	0.0321	[illegible]	0.0829	0.0632	0.0746	
7	0.0500	0.0099	0.0049	0.0291	[illegible]	0.0472	0.0304	
8	0.0228	0.0118	0.0075	0.0054	0.0050	[illegible]	0.0220	
9	0.0095	0.0050	0.0075	0.0045	0.0018	0.0040	[illegible]	
10	0.0034	0.0020	0.0026	0.0054	0.0017	0.0009	0.0011	

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
3	0.0278	0.0282	[illegible]	0.0396	0.0195	[illegible]	0.0409	0.0150	0.0173	0.0069
4	0.0786	0.0762	0.1195	[illegible]	0.0498	0.0982	[illegible]	0.0880	0.0666	0.0594
5	0.1135	0.0699	0.0652	0.0870	[illegible]	0.1211	0.0871	[illegible]	0.0918	0.0668
6	0.0518	0.0610	0.0241	0.0245	0.0545	[illegible]	0.0453	0.0514	[illegible]	0.0365
7	0.0165	0.0165	0.0061	0.0060	0.0203	0.0182	[illegible]	0.0111	0.0124	0.0123
8	0.0045	0.0067	0.0017	0.0014	0.0075	0.0038	0.0022	0.0019	0.0020	0.0015
9	0.0031	0.0029	0.0011	0.0005	0.0026	0.0010	0.0006	0.0002	0.0005	0.0002
10	0.0010	0.0016	0.0006	0.0001	0.0006	0.0002	0.0001	0.0000	0.0000	0.0000

Table 10 Age disaggregated catch rates for otter trawlers TC 1-3 fishing pollock in 4X5, Stronger than average year classes (1979, 1989, 1992) are indicated in grey.

	1982	1983	1984	1985	1986	1987	1988	1989
3		0.1040	0.0356	0.0125	0.0227	0.0145	0.0105	
4	0.0743		0.1562	0.0486	0.0928	0.0572	0.0523	
5	0.0186	0.0446		0.1376	0.0897	0.0999	0.0743	
6	0.0457	0.0050	0.0321		0.0829	0.0632	0.0746	
7	0.0500	0.0099	0.0049	0.0291		0.0472	0.0304	
8	0.0228	0.0118	0.0075	0.0054	0.0050		0.0220	
9	0.0095	0.0050	0.0075	0.0045	0.0018	0.0040		
10	0.0034	0.0020	0.0026	0.0054	0.0017	0.0009	0.0011	

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
3	0.0278	0.0282		0.0396	0.0195		0.0409	0.0150	0.0173	0.0069
4	0.0786	0.0762	0.1195		0.0498	0.0982		0.0880	0.0666	0.0594
5	0.1135	0.0699	0.0652	0.0870		0.1211	0.0871		0.0918	0.0668
6	0.0518	0.0610	0.0241	0.0245	0.0545		0.0453	0.0514		0.0365
7	0.0165	0.0165	0.0061	0.0060	0.0203	0.0182		0.0111	0.0124	0.0123
8	0.0045	0.0067	0.0017	0.0014	0.0075	0.0038	0.0022	0.0019	0.0020	0.0015
9	0.0031	0.0029	0.0011	0.0005	0.0026	0.0010	0.0006	0.0002	0.0005	0.0002
10	0.0010	0.0016	0.0006	0.0001	0.0006	0.0002	0.0001	0.0000	0.0000	0.0000

Table 11. Summary of resource status indicators for 4VWX5Zc pollock.

Attribute	Recent Trends	Current Status
Biomass SPA Ages 5+, 1982-1999	Unchanged	Below average.
Exploitation Rate SPA, Ages 4-7, 1982-1999	Has fluctuated around target since 1995 ($F_{0.1}$)	Close to lowest observed.
Recruitment SPA Age 2 1982-1999	Decreasing	Close to lowest observed.
Condition Factor (surveys, 1988-1998)	Unchanged	Interpretation difficult due to much interannual variation.
Resource concentration (surveys, 1970 to 1999)	More concentrated (less evenly distributed)	Less concentrated than that observed during 1970s and 1980s.
Geographic range (surveys, 1970 to 1999)	Decreasing	Followed increasing trend until 1993, decreasing until present.
Growth rate (fishery, 1990 to 1998)	Increasing	Highest observed.
Age/size range (fishery and surveys, 1970 to 1999)	Decreasing	Fewer larger/older fish in catch and surveys.
Catch rates (mobile gear, 1982 to 1999)	Decreasing	Lowest observed.
Fishermens' reports (1999 compared recent past)		Fishery poorer than average for most sectors and areas except positive reports from eastern 4X, 4W.

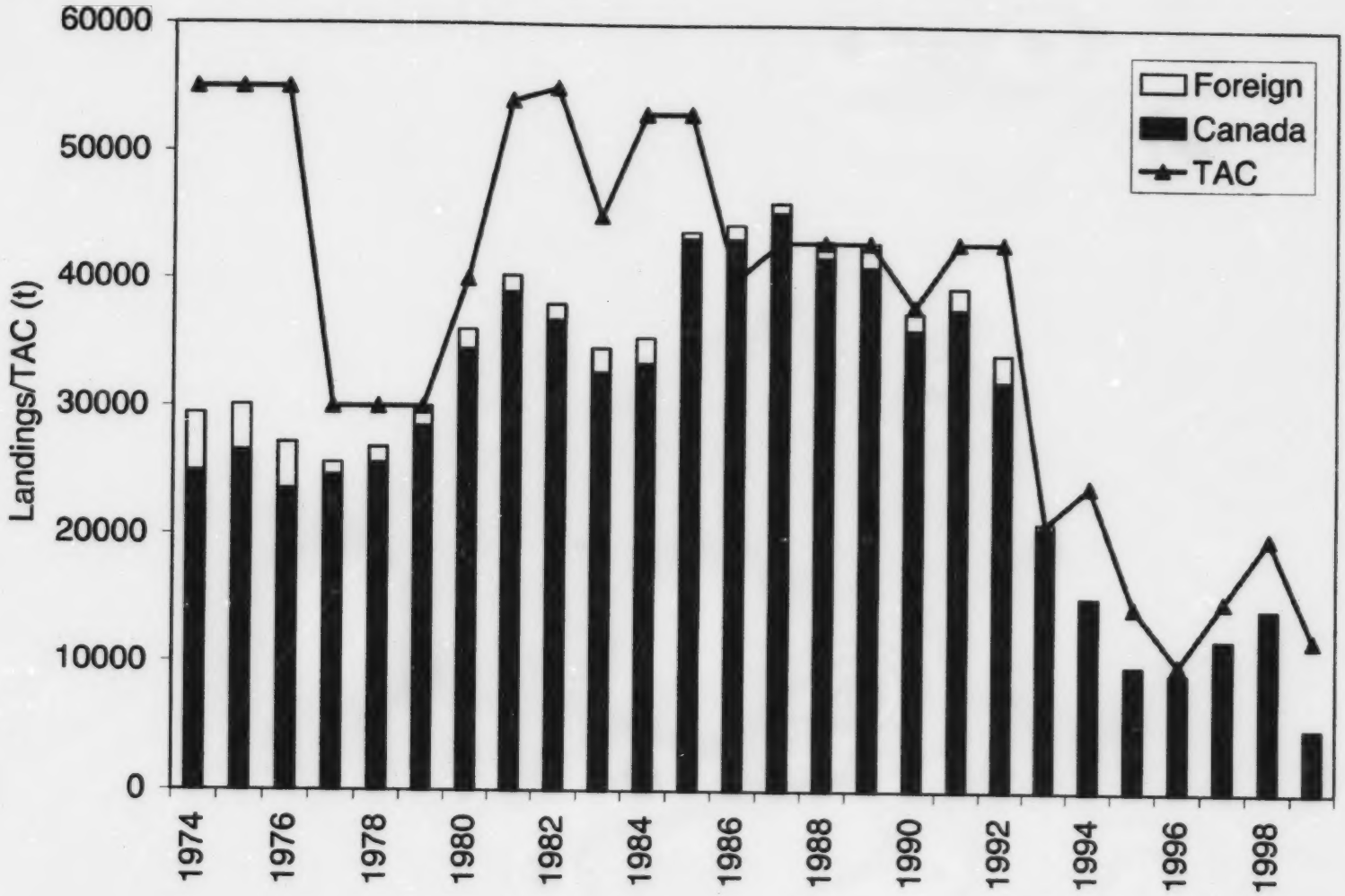


Fig. 1. Landings of 4VWX5Zc pollock by Canada and foreign countries, shown with respect to the TAC.

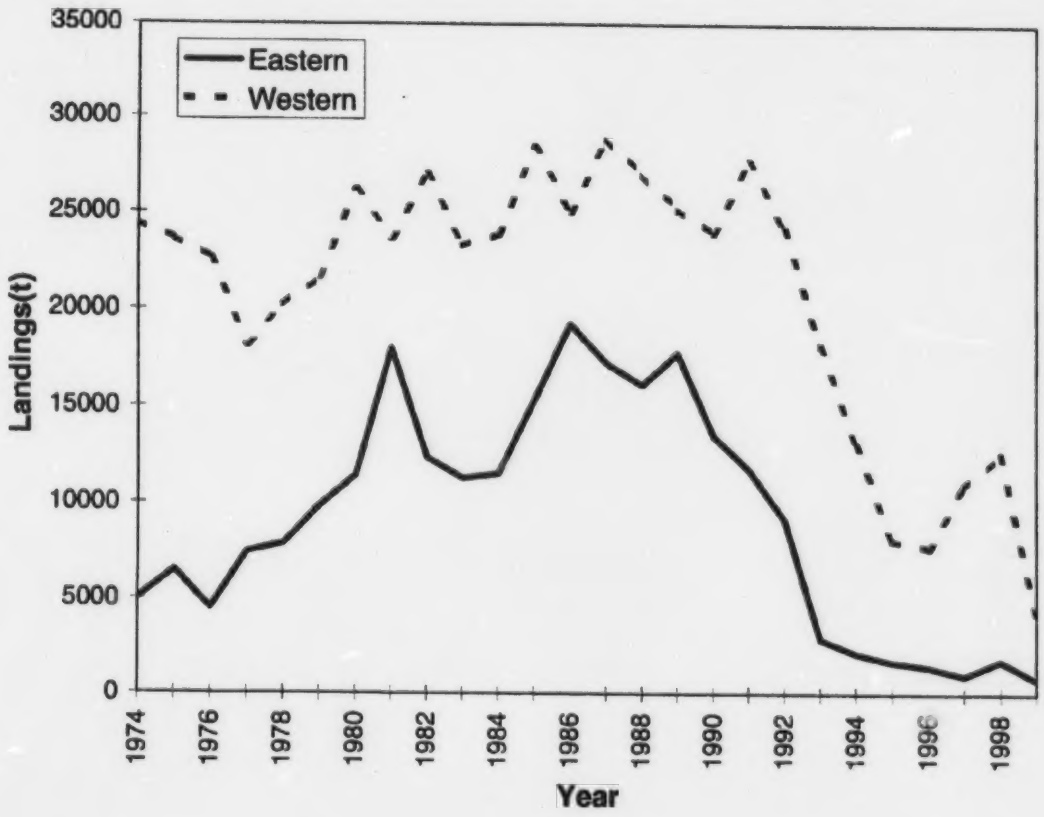


Fig. 2. Landings of 4VWX5Zc pollock, split into eastern and western halves of the management unit.

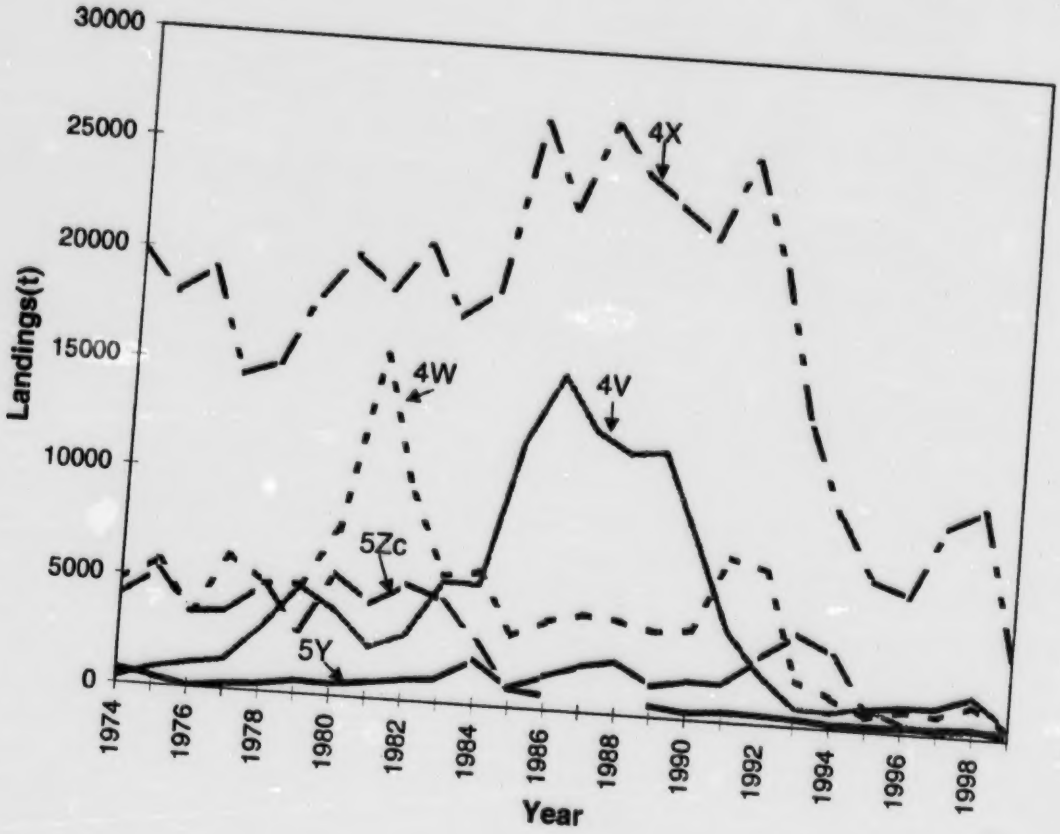


Fig. 3. Landings of 4VWX5Zc pollock by NAFO division.

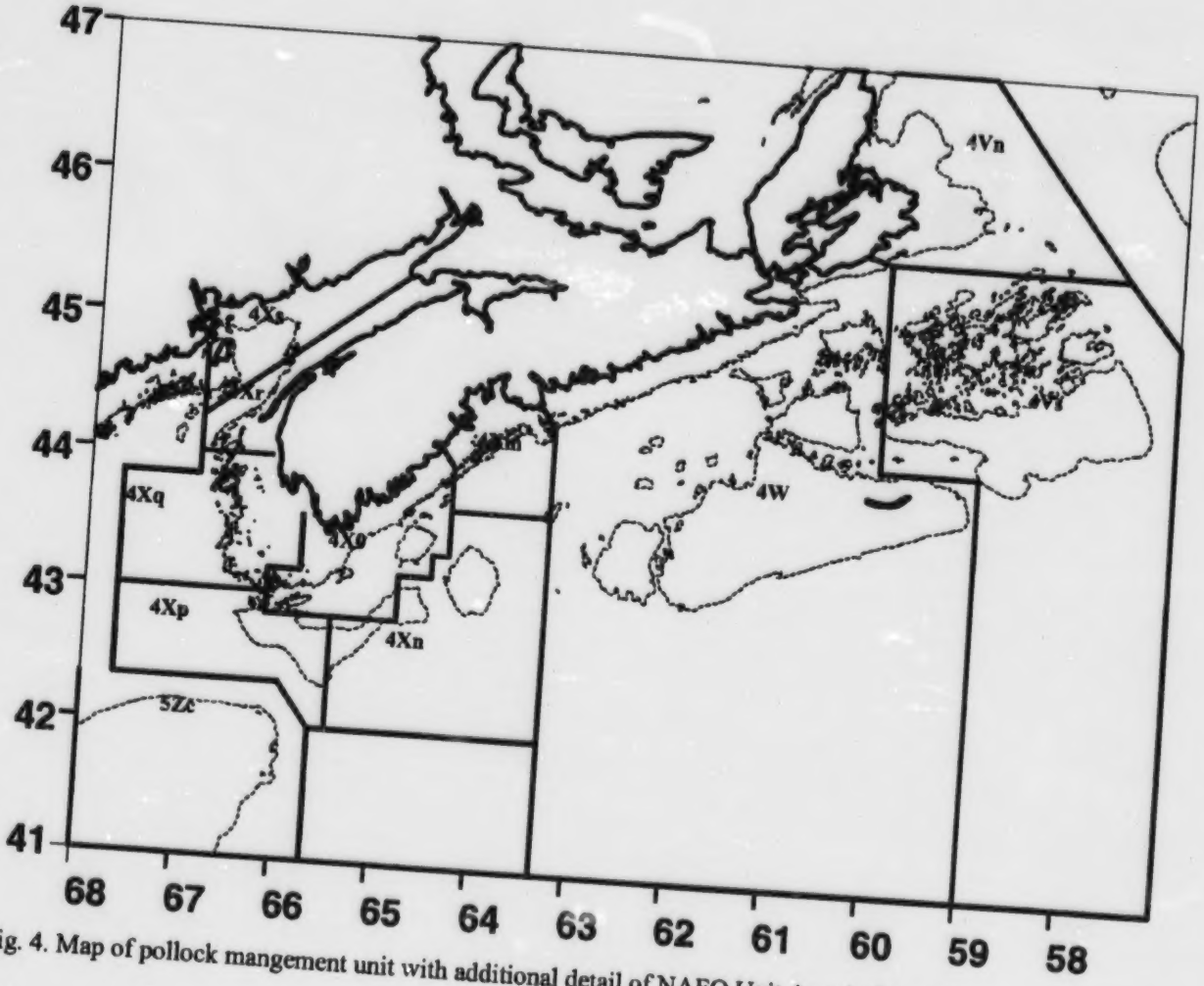


Fig. 4. Map of pollock mangement unit with additional detail of NAFO Unit Area in Div. 4X.

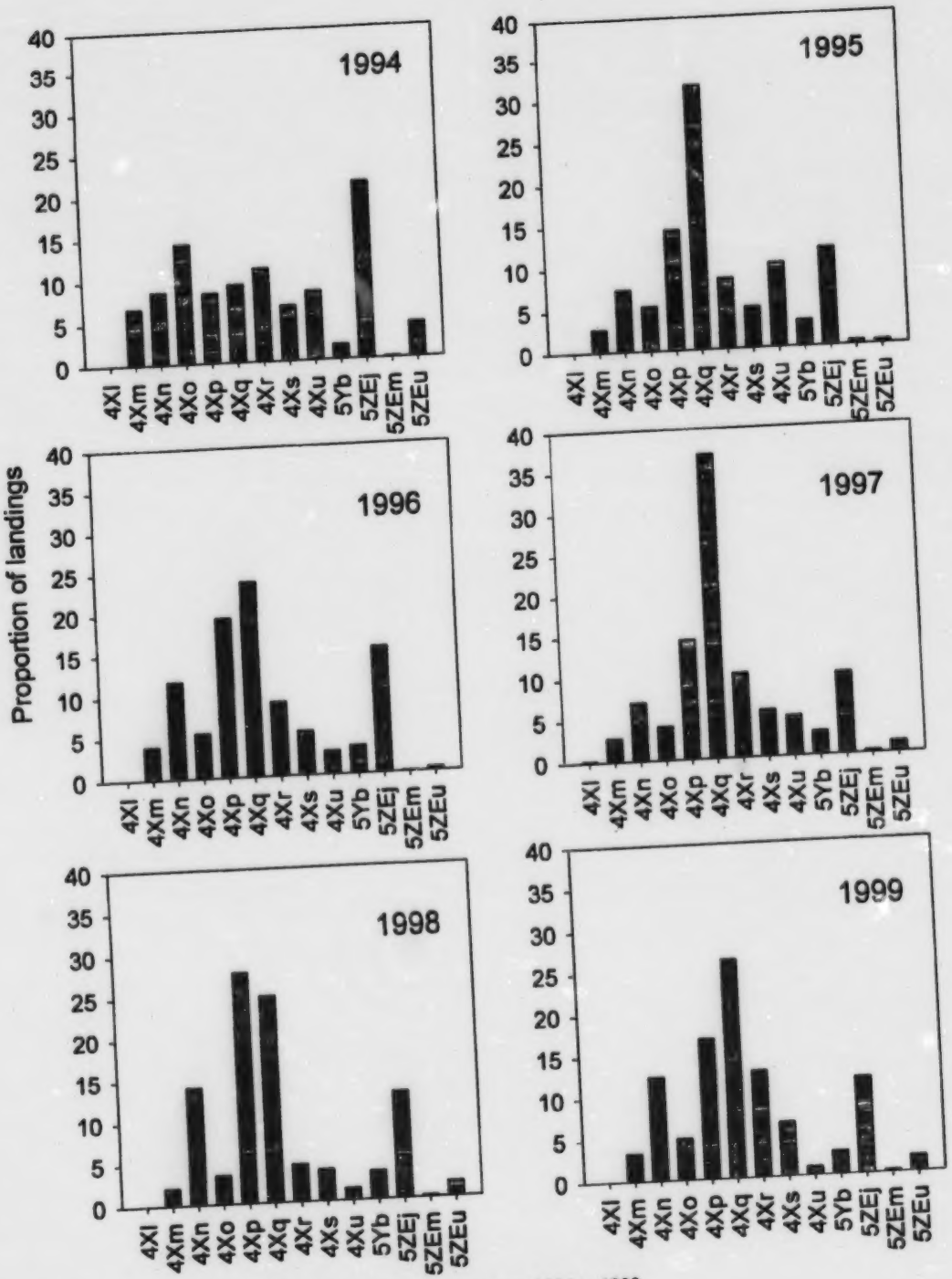


Fig.5. Proportion of pollock landings by NAFO unit area from 1994 to 1999.

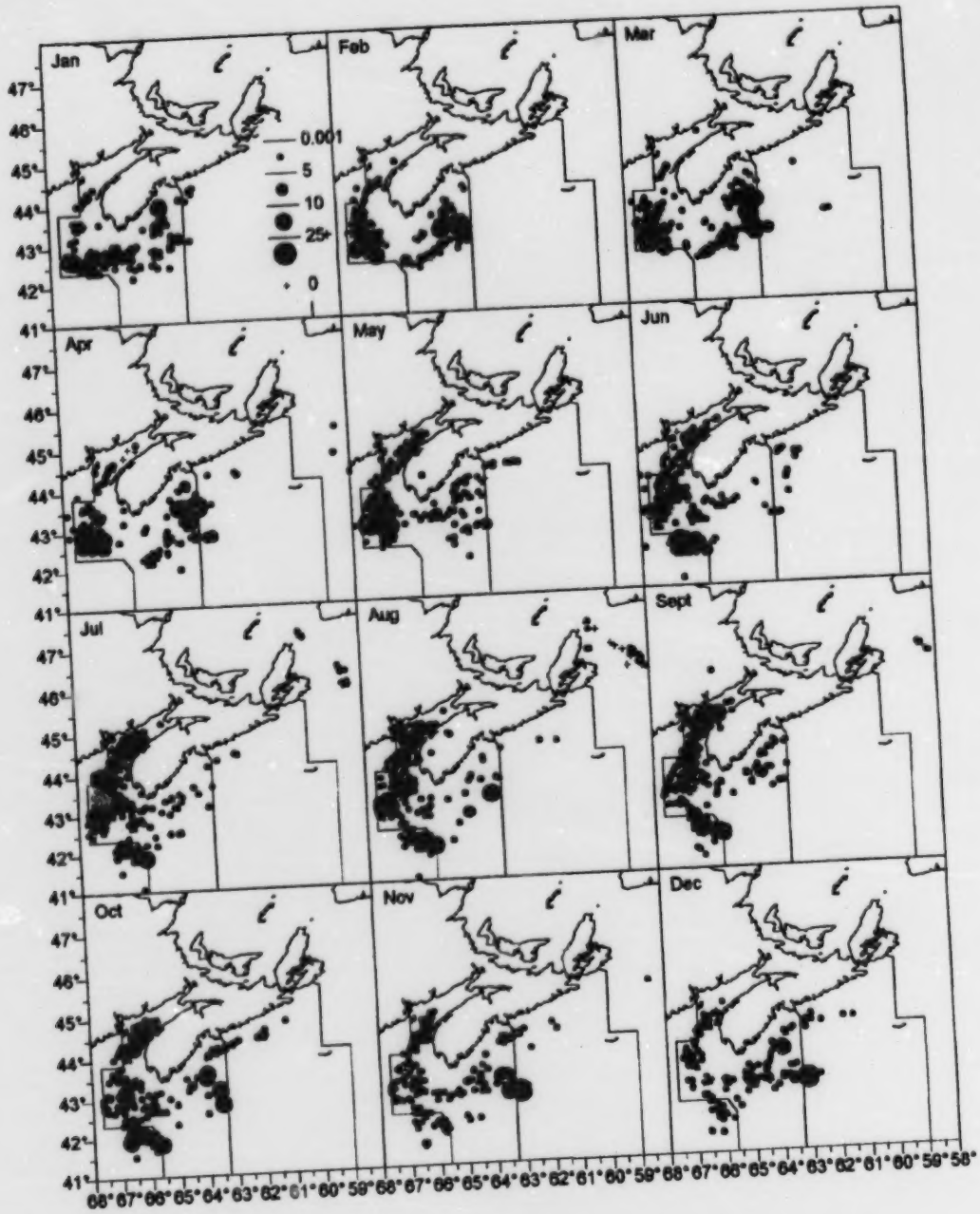


Fig.6. Distribution of pollock landings in Nafo Divisions 4VWX5Zc in 1998, TC 1-3 small mobile gear.

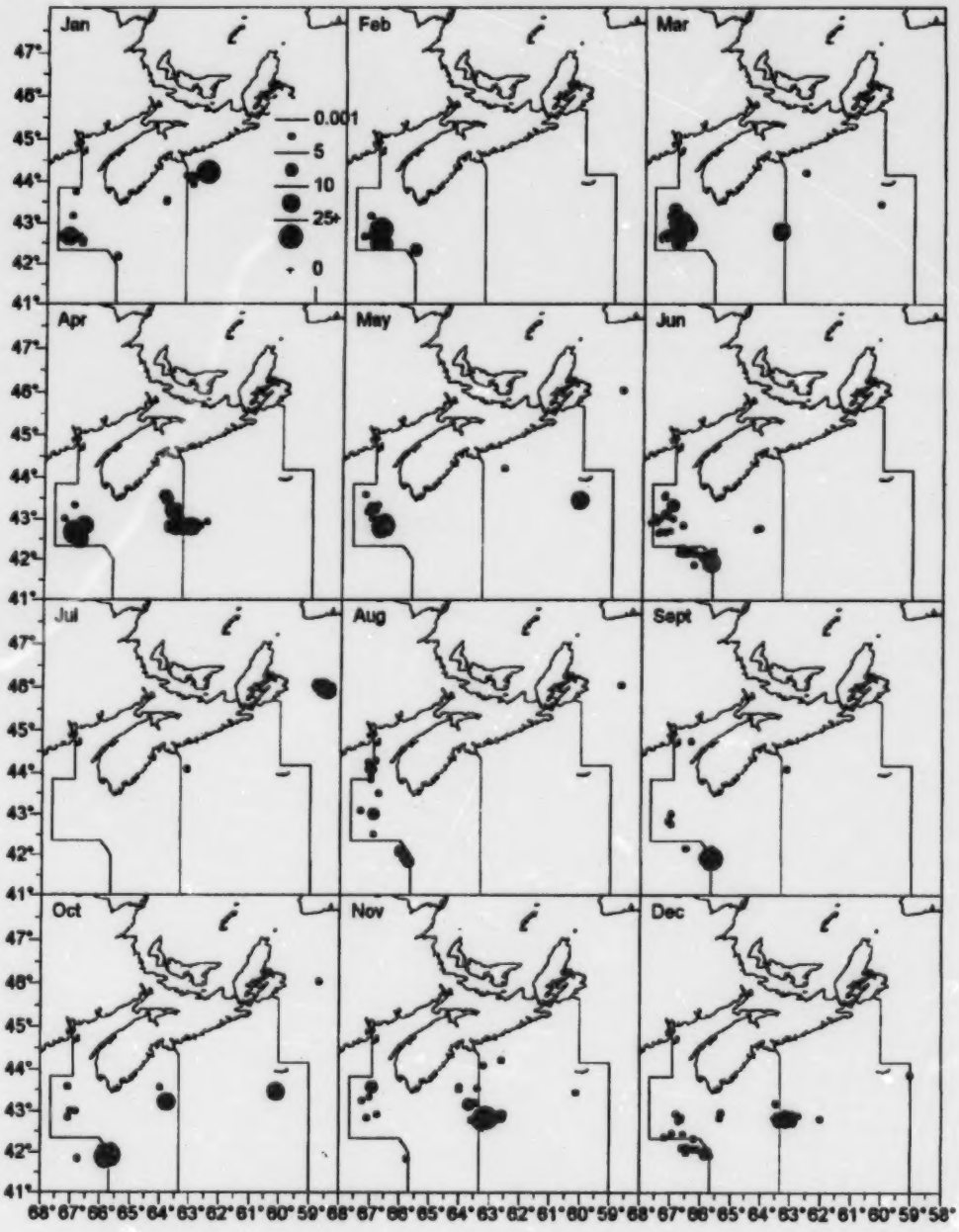


Fig.7. Distribution of pollock landings by month in 4VWX5Zc in 1998,TC 4+ mobile gear.

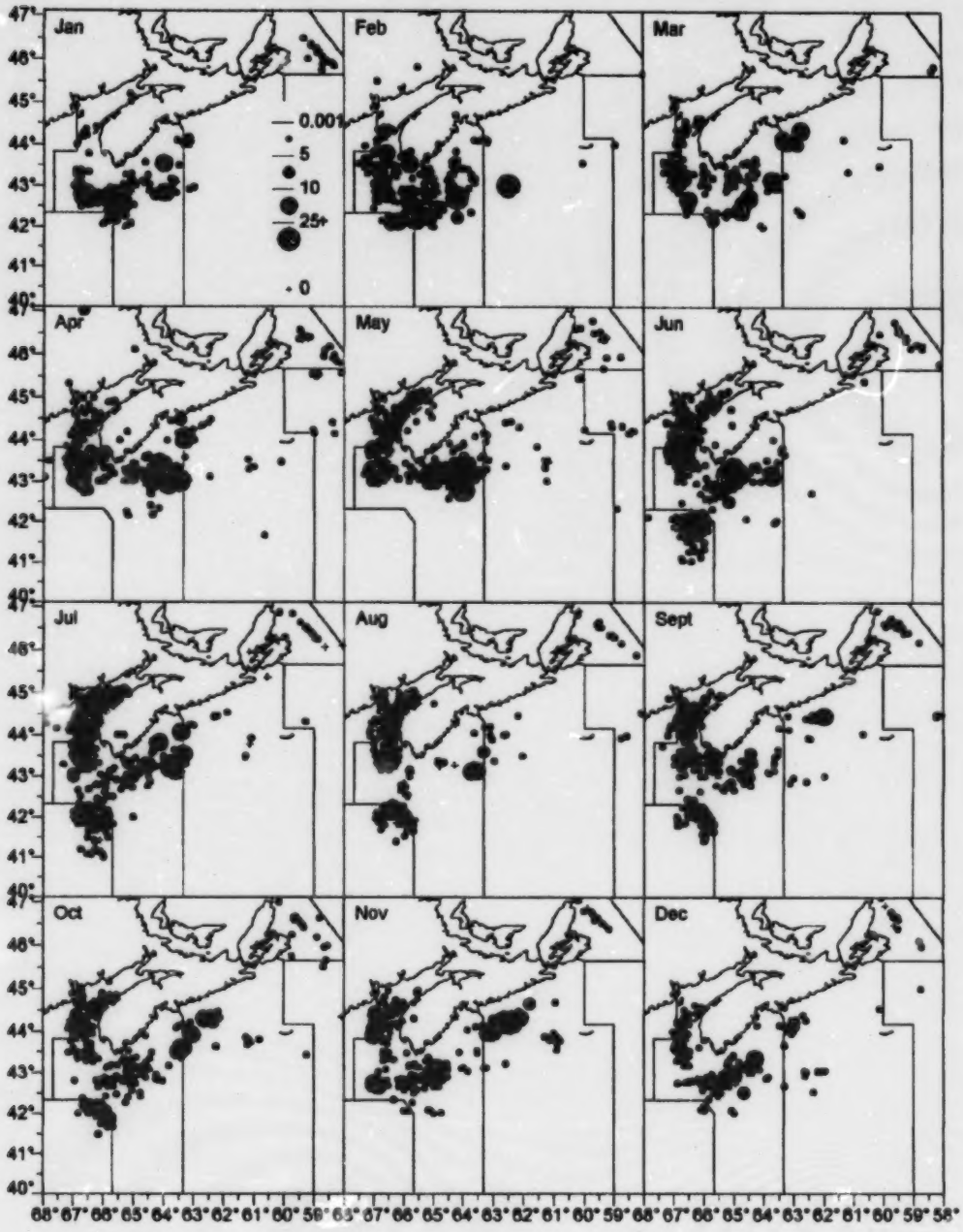


Fig.8. Distribution of pollock landings by month in 4VWX5Zc in 1991, TC 1-3 mobile gear.

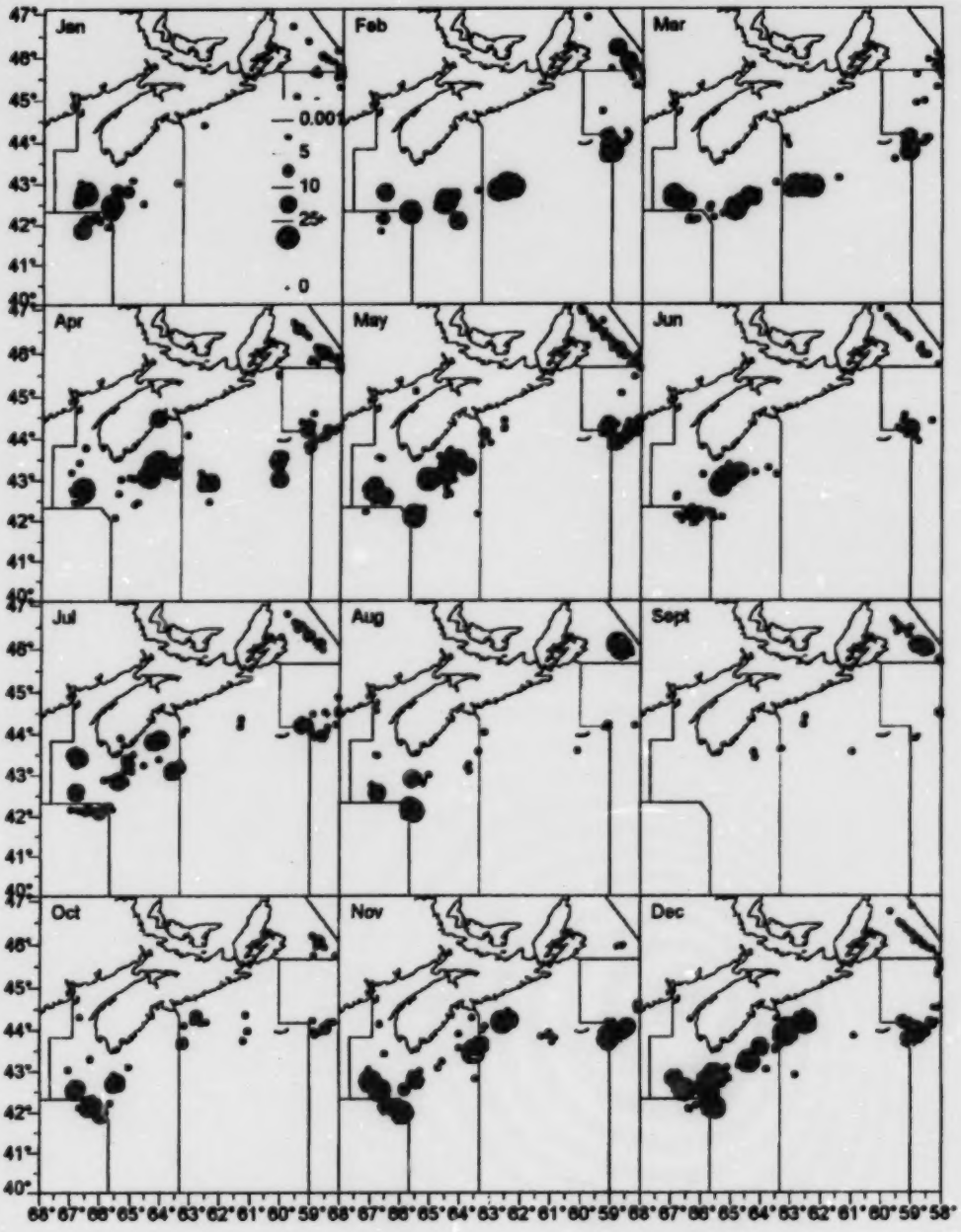


Fig. 9. Distribution of pollock landings by month in 4VWX5Zc in 1991, TC 4+ mobile gear.

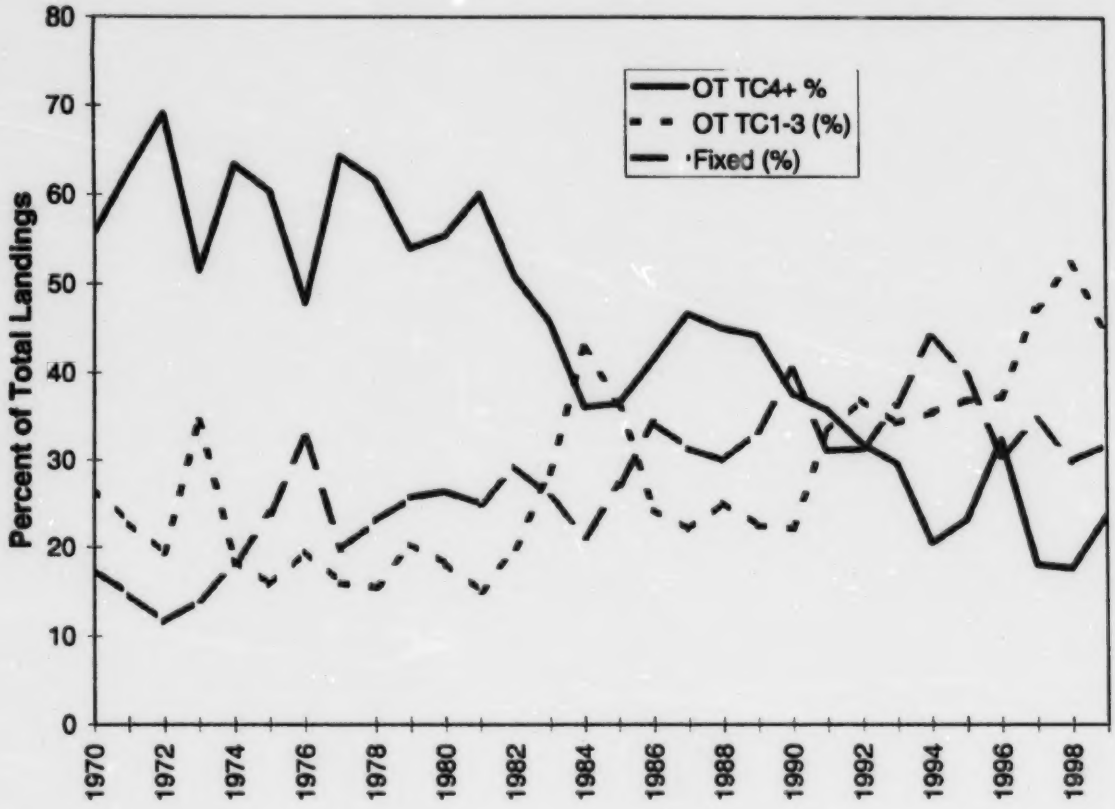


Fig. 10. Landings of 4VWX5Zc pollock by major gear type.

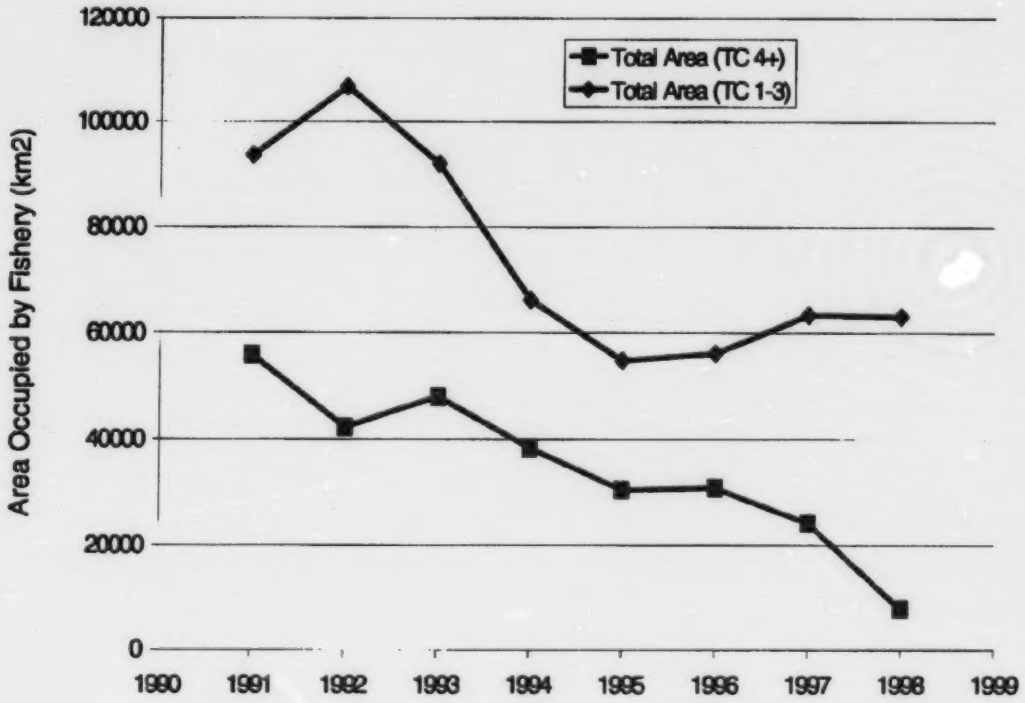


Fig.11. Total area occupied by the mobile gear in NAFO Divisions 4VWX5Zc pollock fishery in km^2

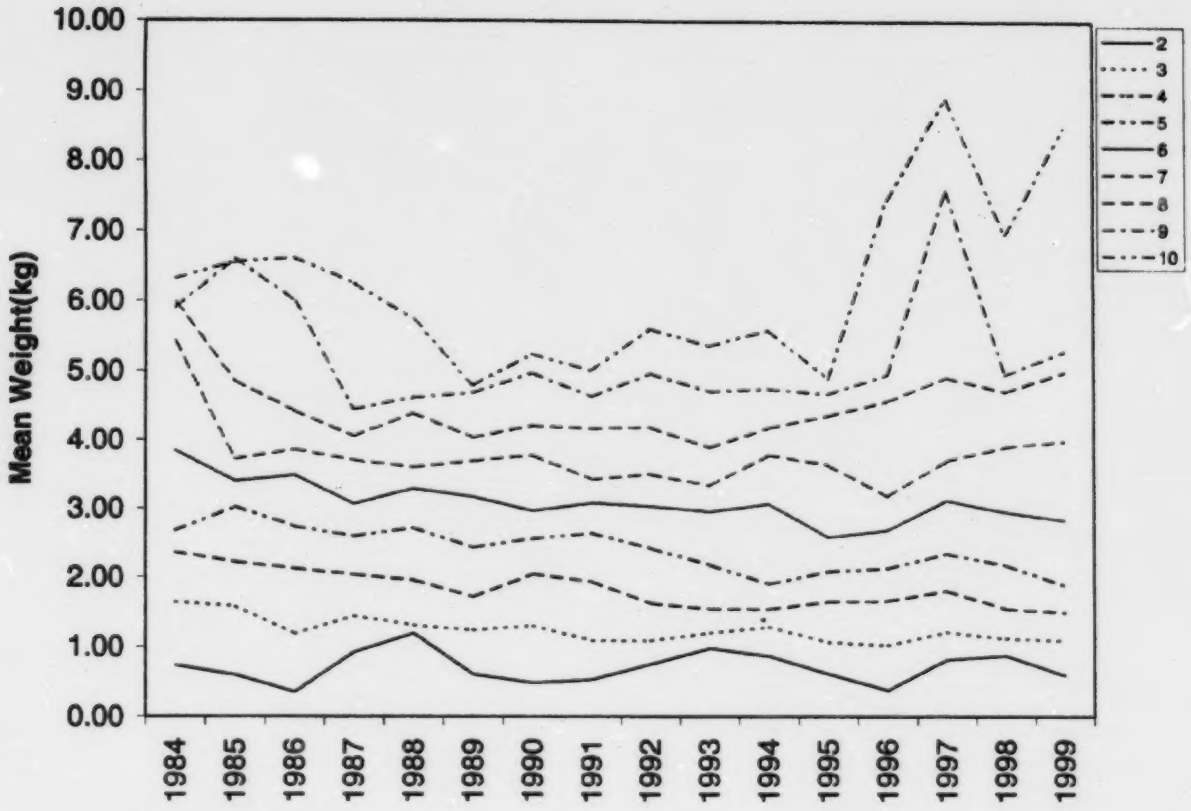


Fig. 12. Trend in mean weight at age from the 4VWX5Zc pollock fishery, 1984 to 1999.

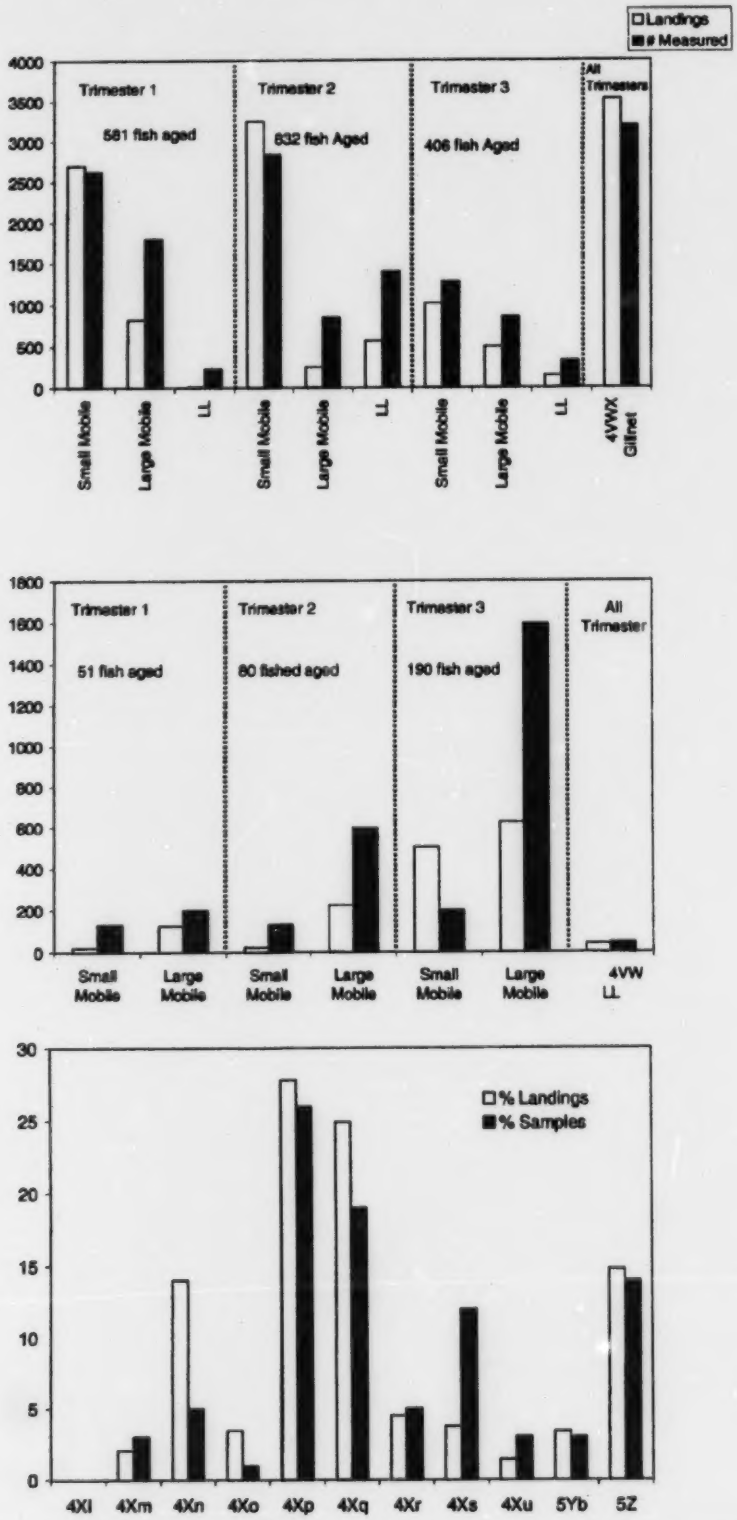


Fig. 13. Landings and number of pollock measured by gear type, area and trimester for 1998(upper panel). Bottom panel illustrates the percent of samples vs percent of landings for 4X5 for 1998.

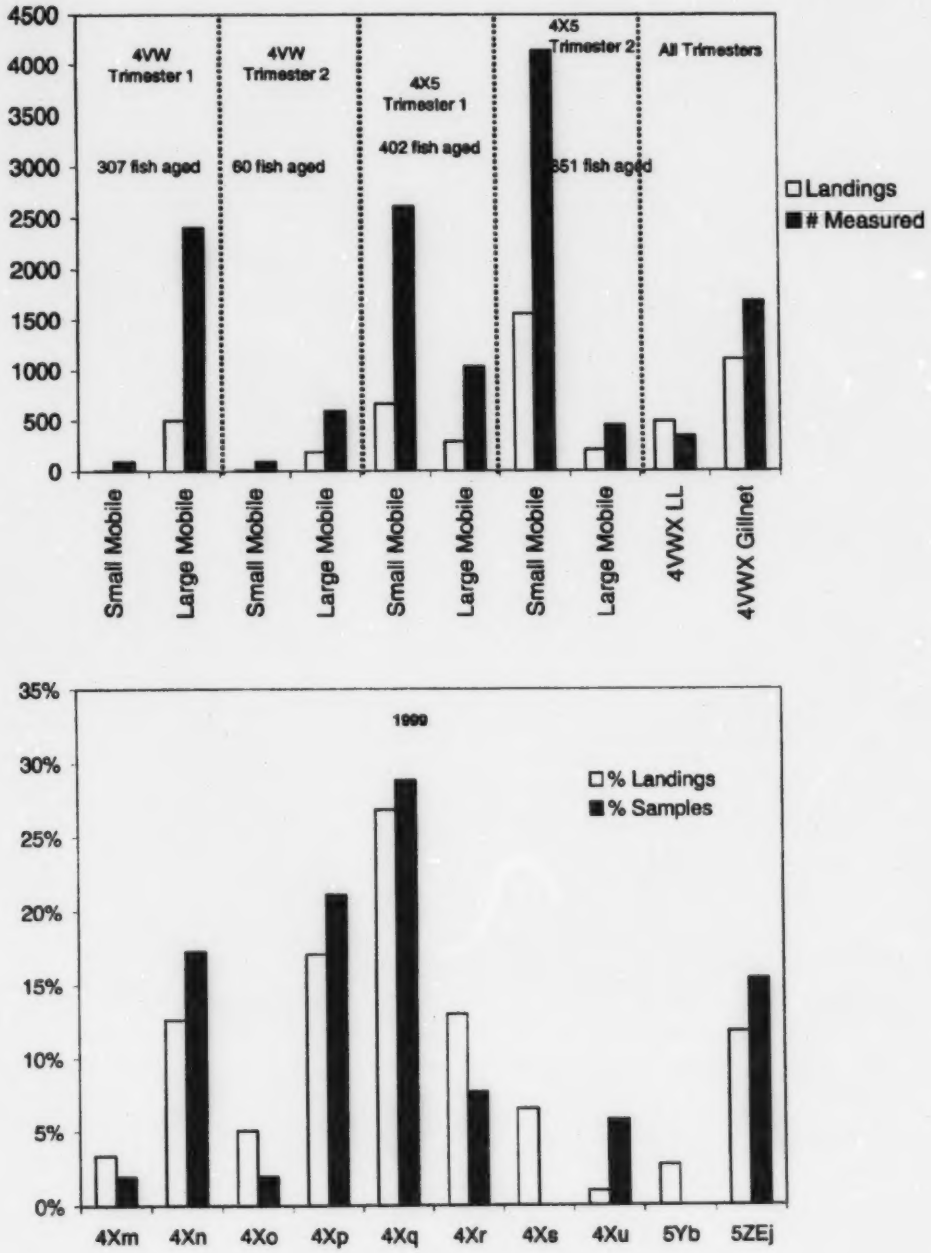


Fig. 14. Landings and number of pollock measured by gear type, area and trimester for 1999(upper panel). Bottom panel illustrates the percent of samples vs percent of landings for 4X5 for 1999.

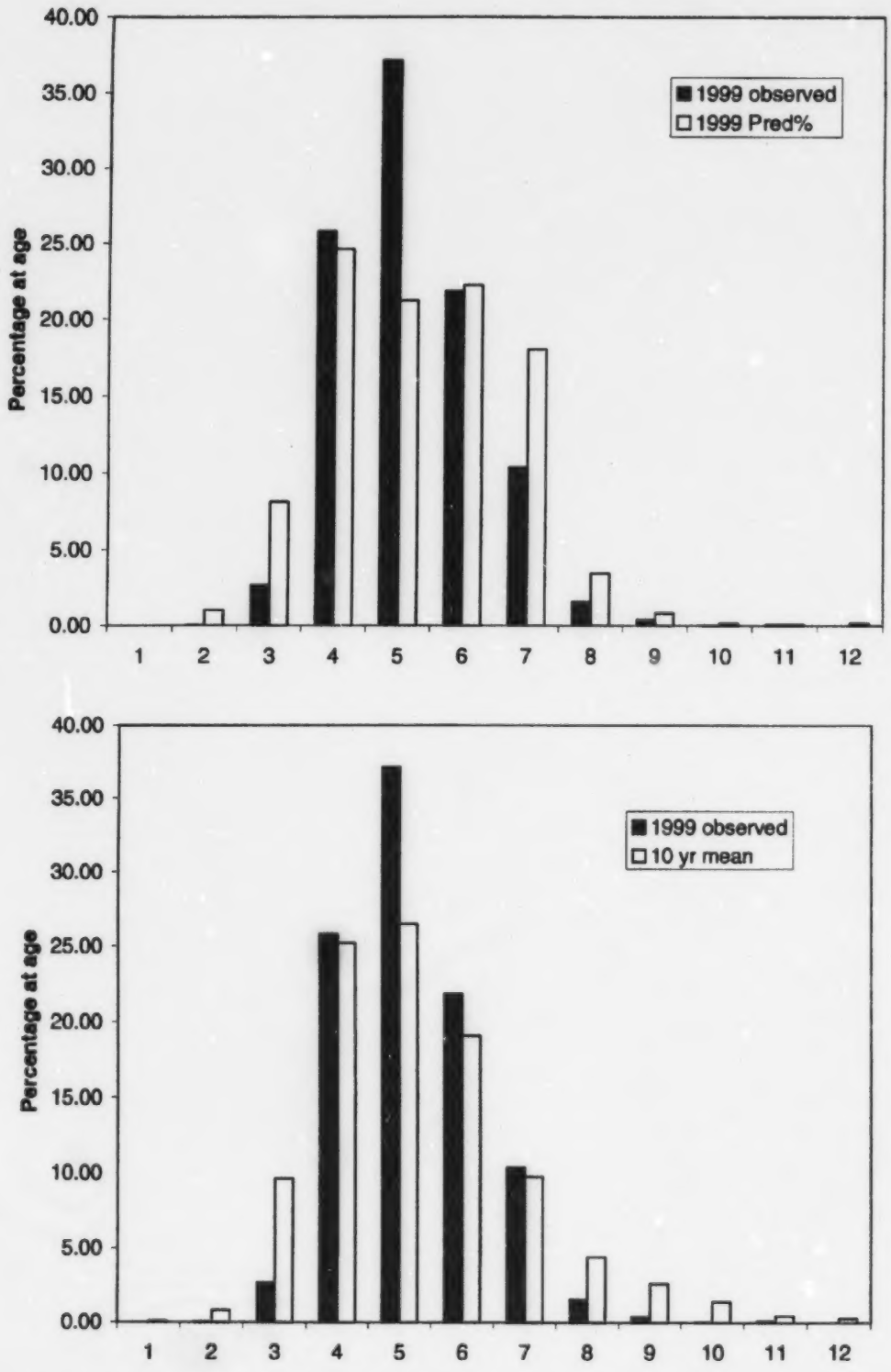


Fig. 15. (Upper panel) Comparison of observed and expected catch composition by age, pollock in 4VWX5Zc, 1999, (Bottom panel) observed age composition in 1999 (percent) compared with the ten year mean. Pollock in 4VWX5Zc.

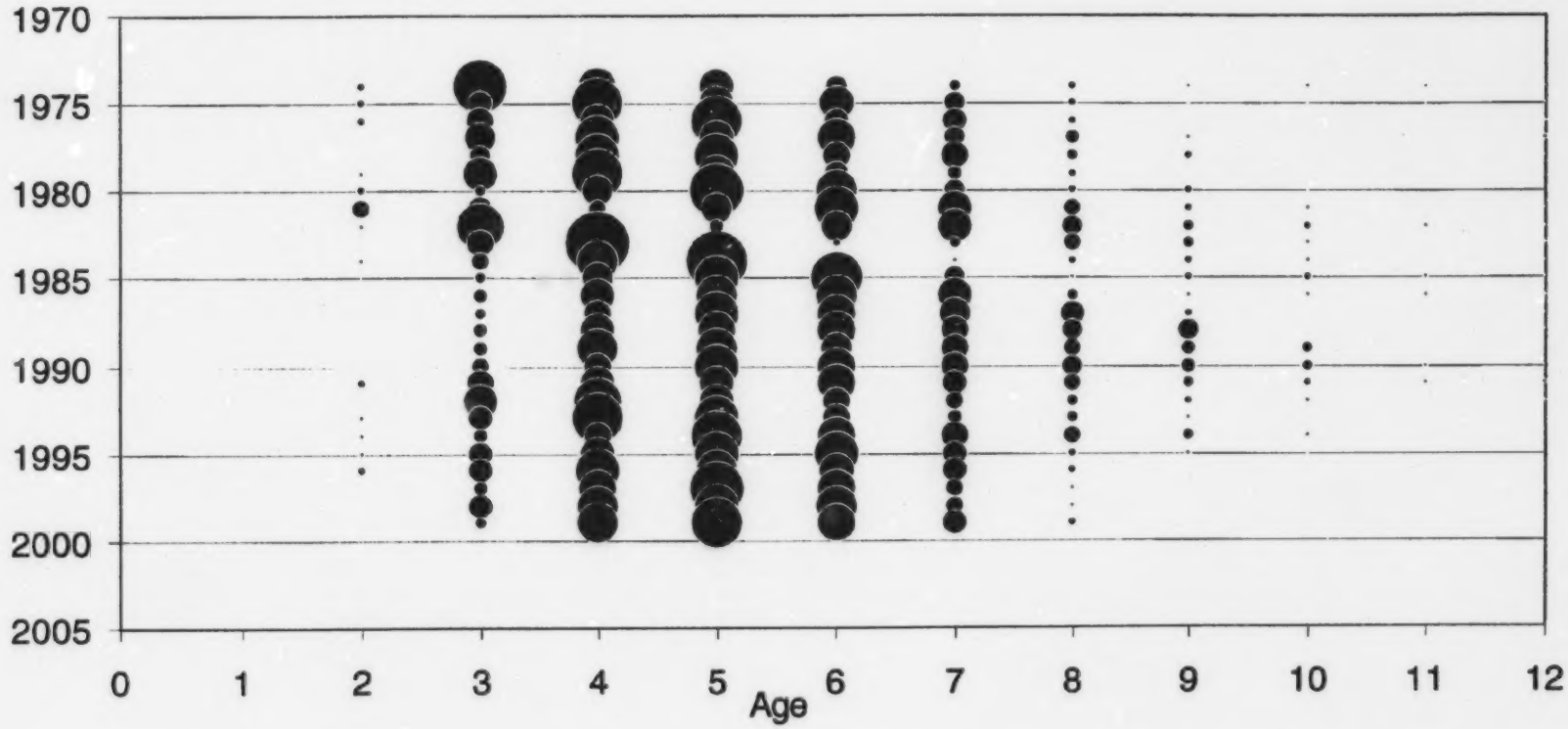


Fig. 16. Catch at age of pollock in the Canadian fishery (1974-1999). The size of the symbol is proportional to the catch at age, shown as a proportion of the total catch at age in that year.

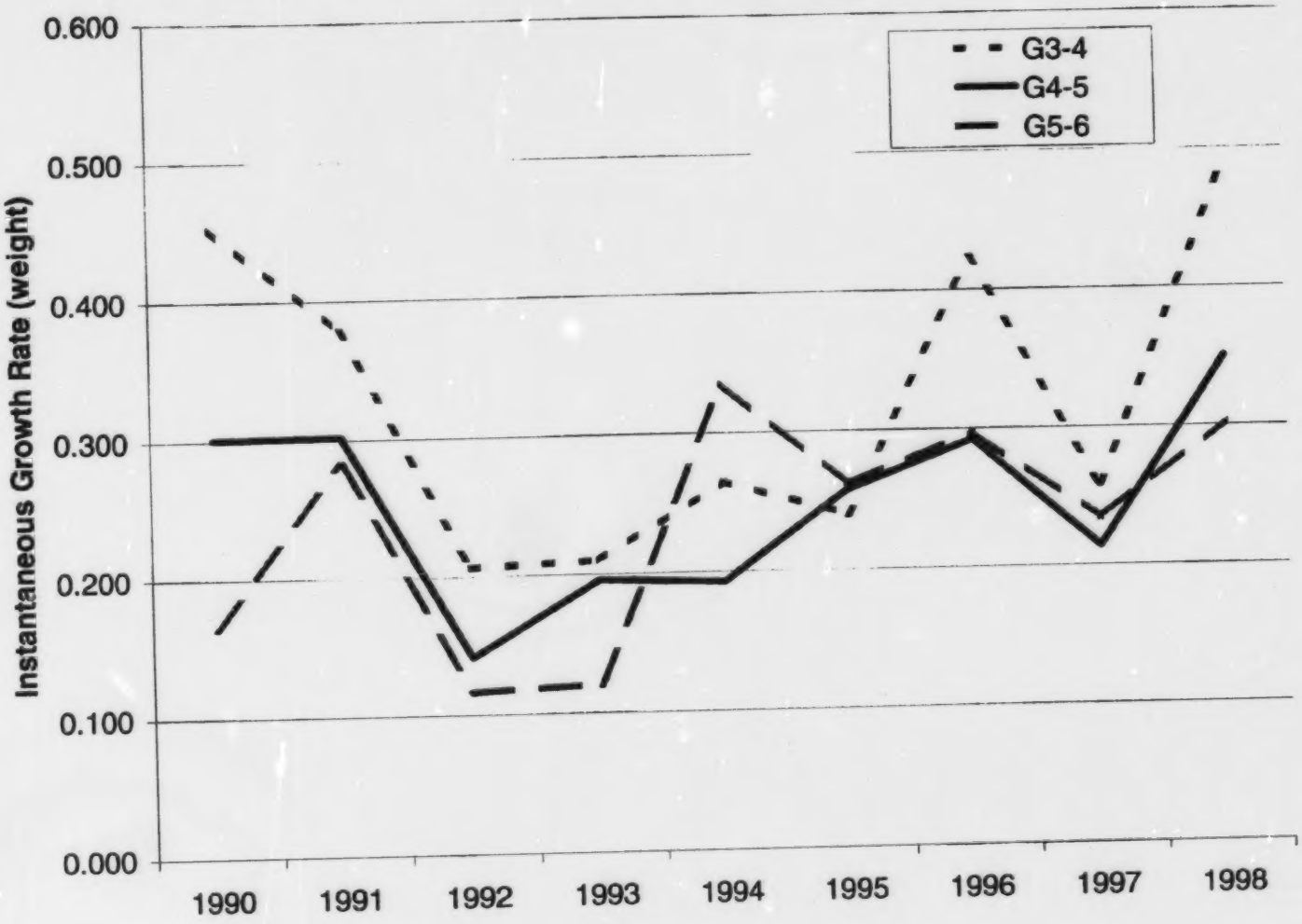


Fig.17. Instantaneous growth rates calculated from the commercial fishery catch at age over ages 3 to 4, ages 4 to 5 and ages 5 to 6 in NAFO Divisions 4VWX5Zc.

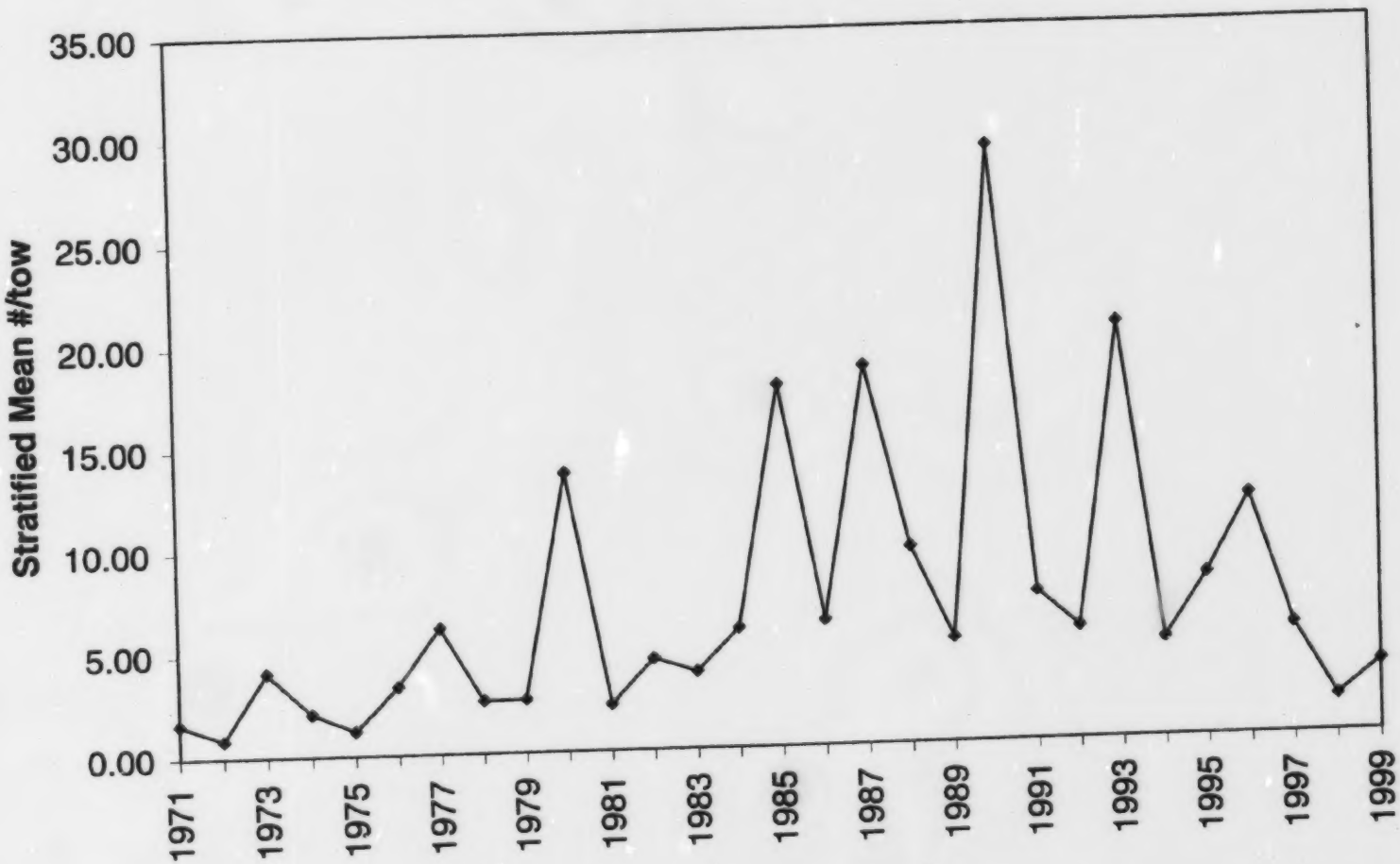


Fig.18. Pollock catch per tow from summer RV surveys. Strata included were 440-495

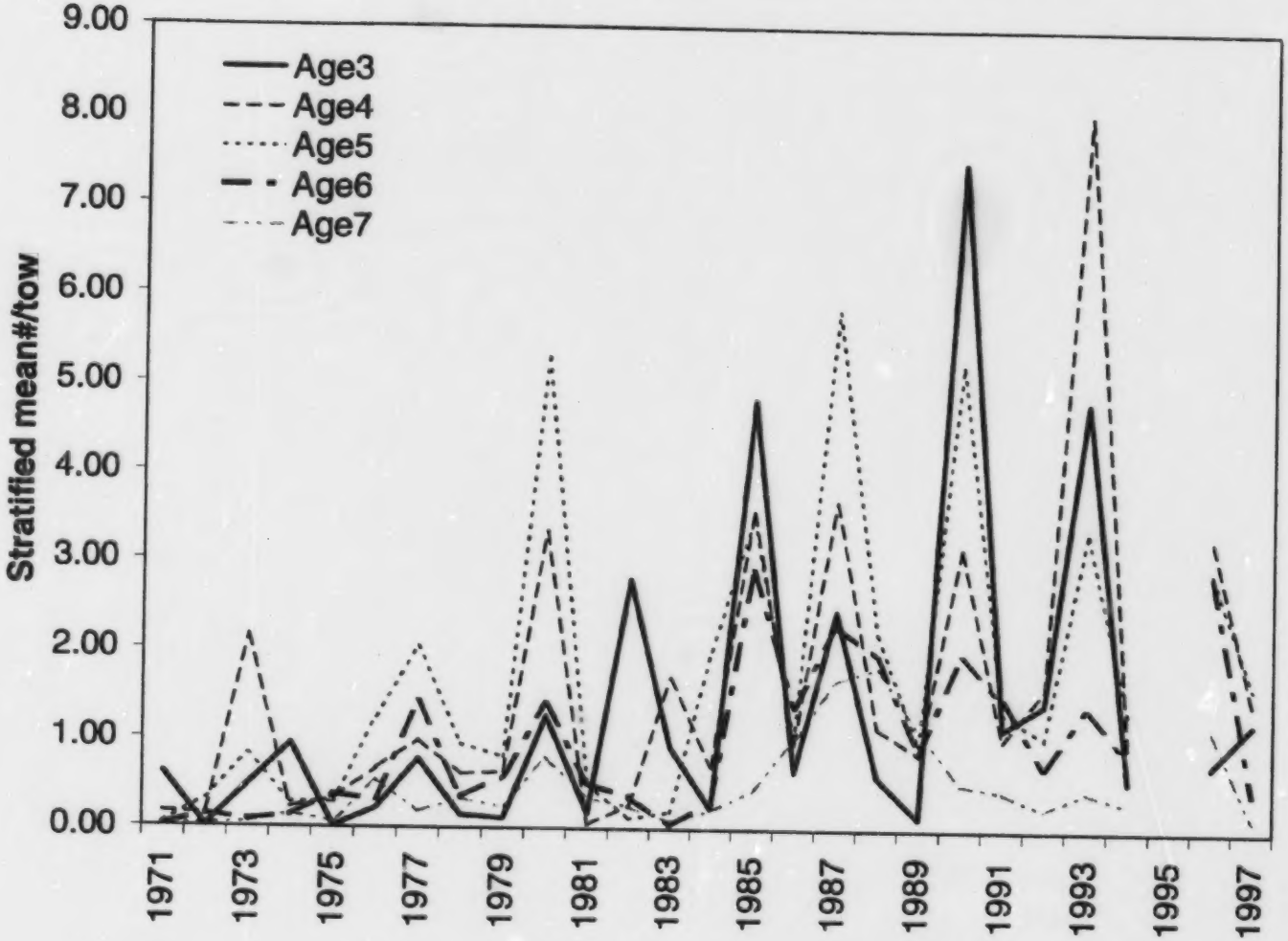


Fig.19. Pollock catch per tow from summer surveys, disaggregated by age (1971-1997, 4VWX).

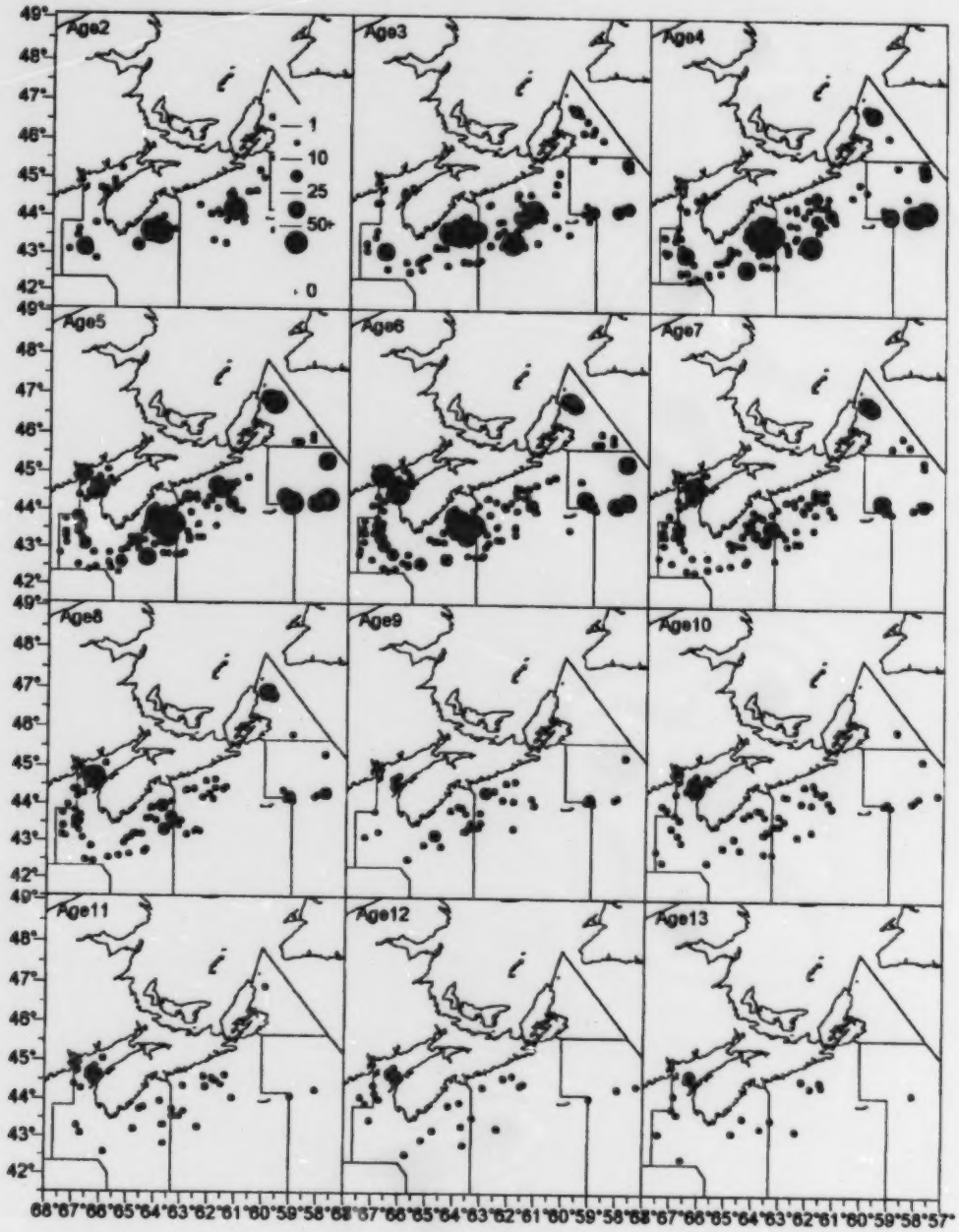


Fig. 20a. Distribution of pollock by age in 4VWX from the summer RV surveys, 1983-1987.

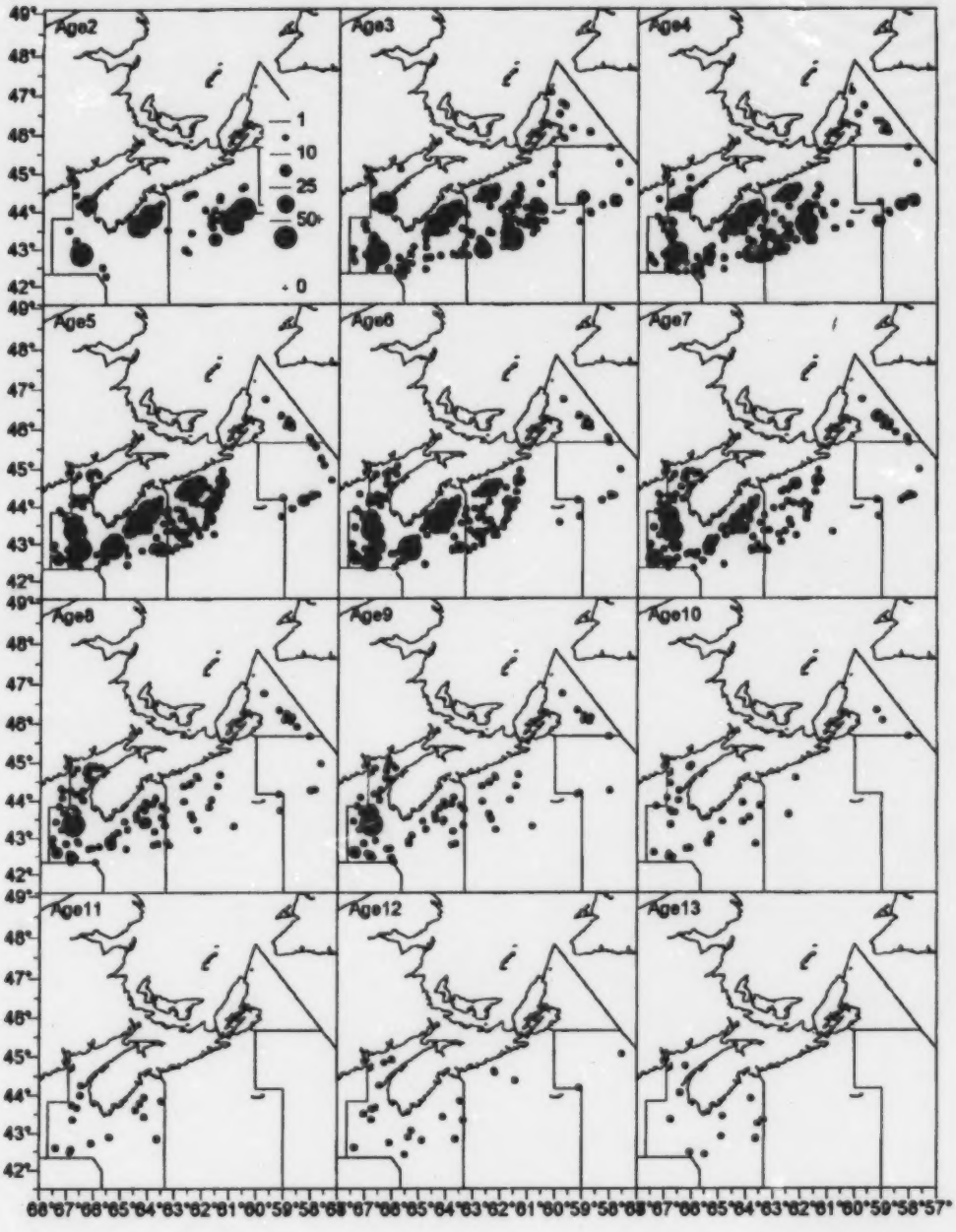


Fig. 20b. Distribution of pollock by age in 4VWX from the summer RV surveys, 1988-1992.

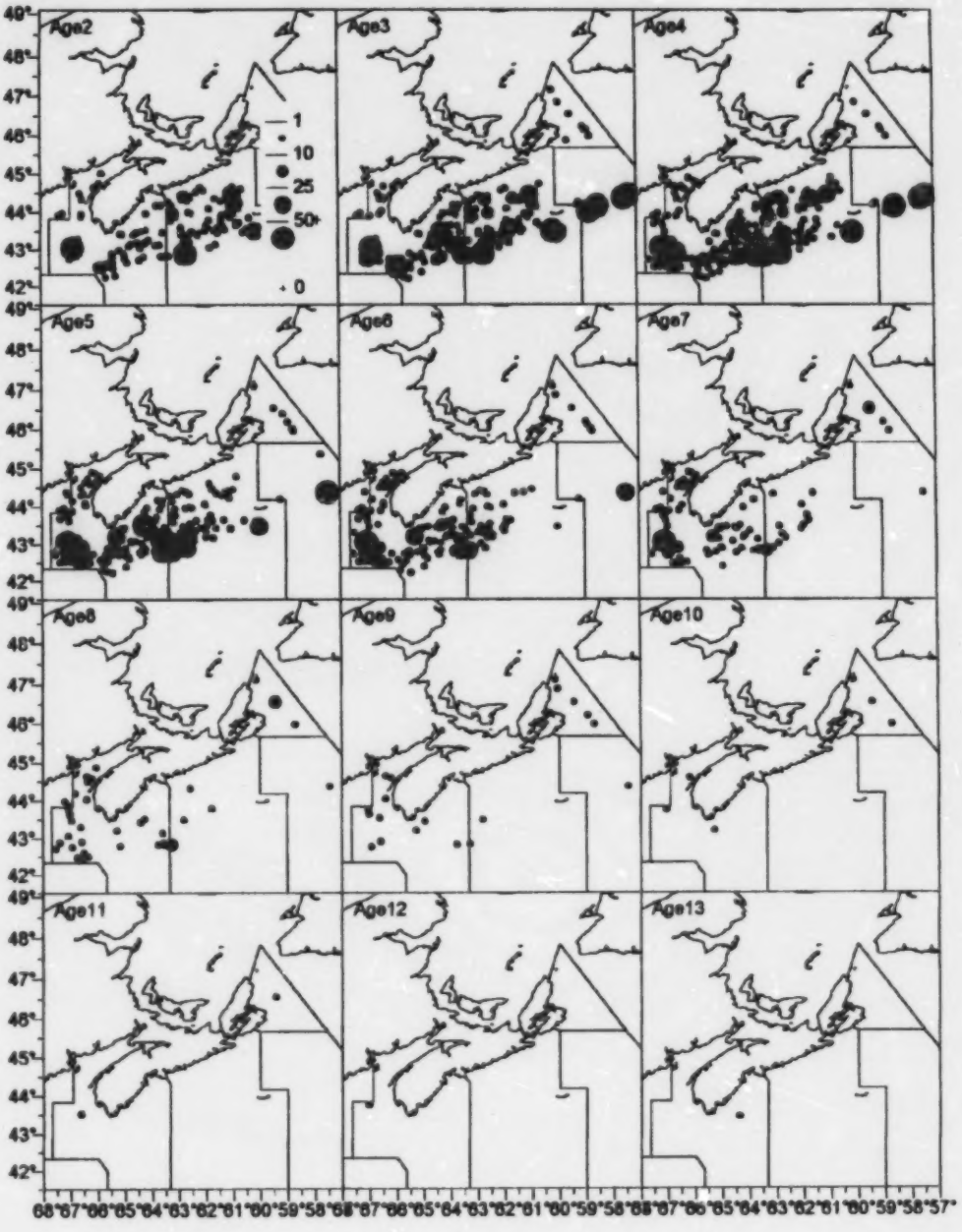


Fig. 20c. Distribution of pollock by age in 4VWX from the summer RV surveys, 1993-1997.

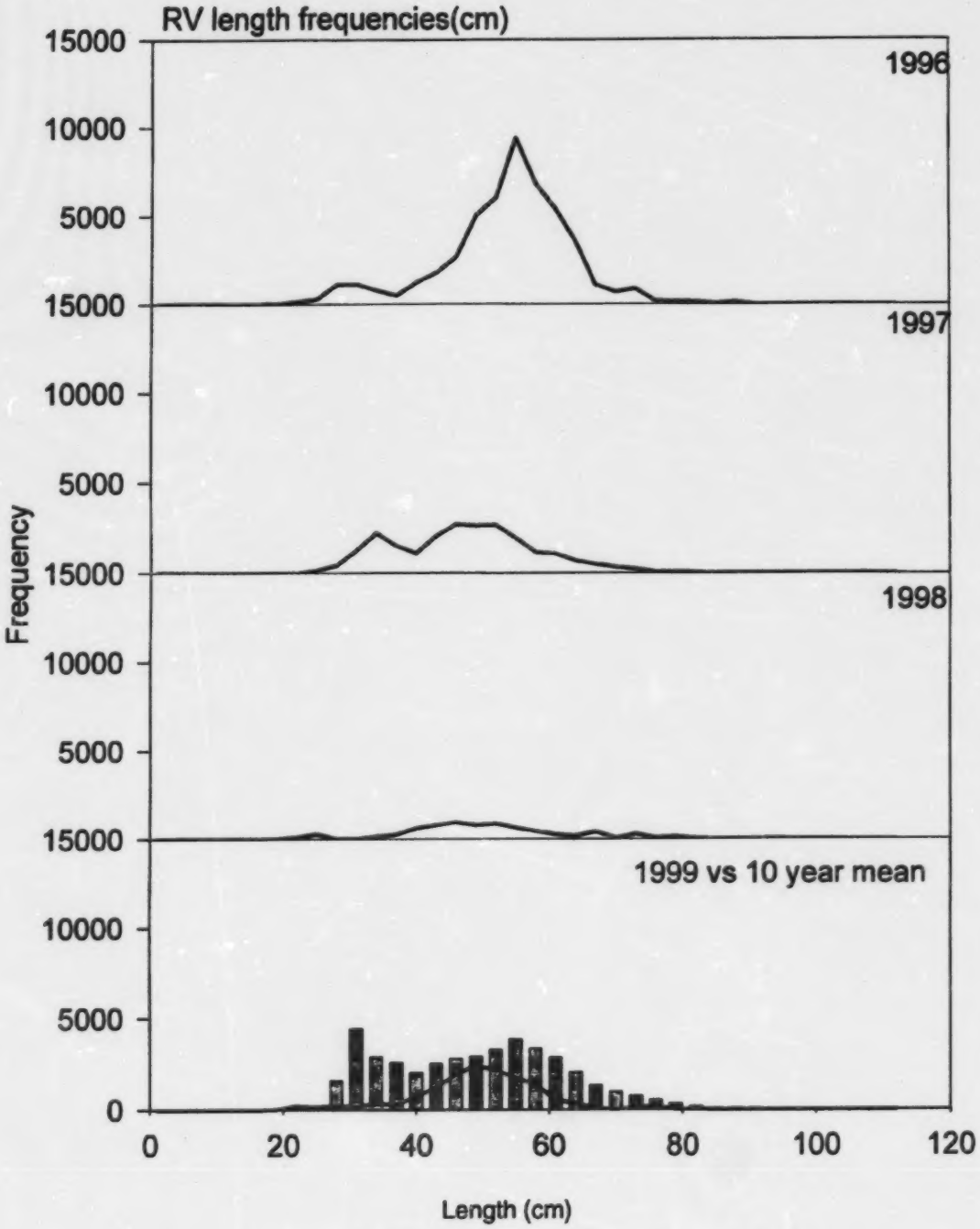


Fig. 21. Pollock length frequency distribution from summer groundfish surveys, 1996-1999. The 10-year mean is the histogram on the bottom panel.

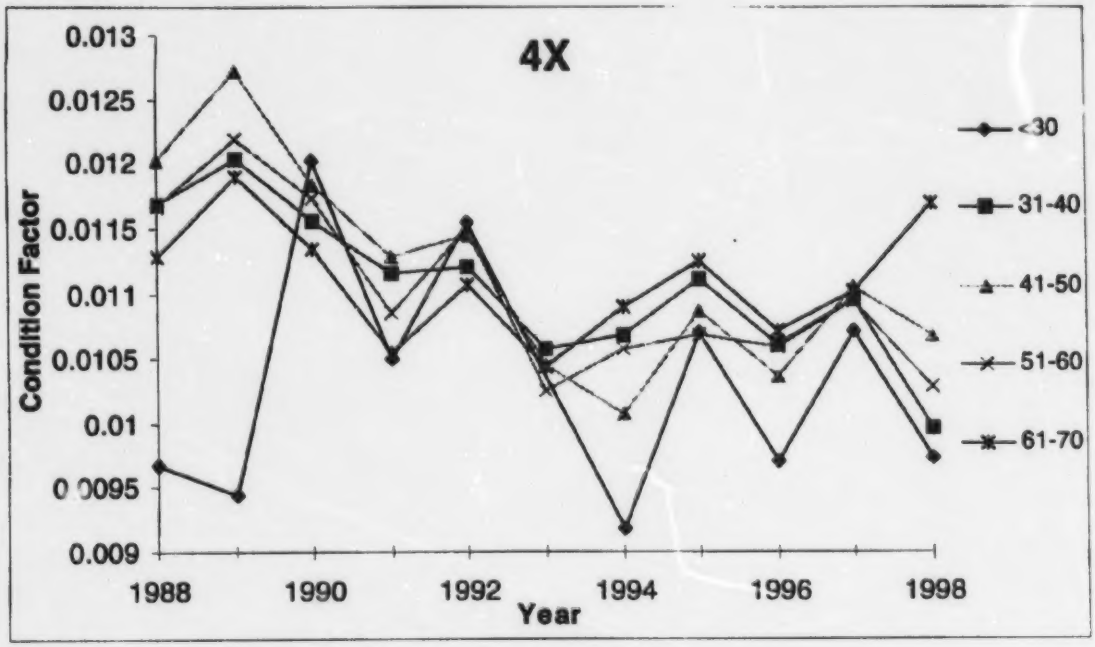


Fig. 22. Trends in Fulton's K (condition factor) in pollock taken during research surveys in NAFO Div. 4X.

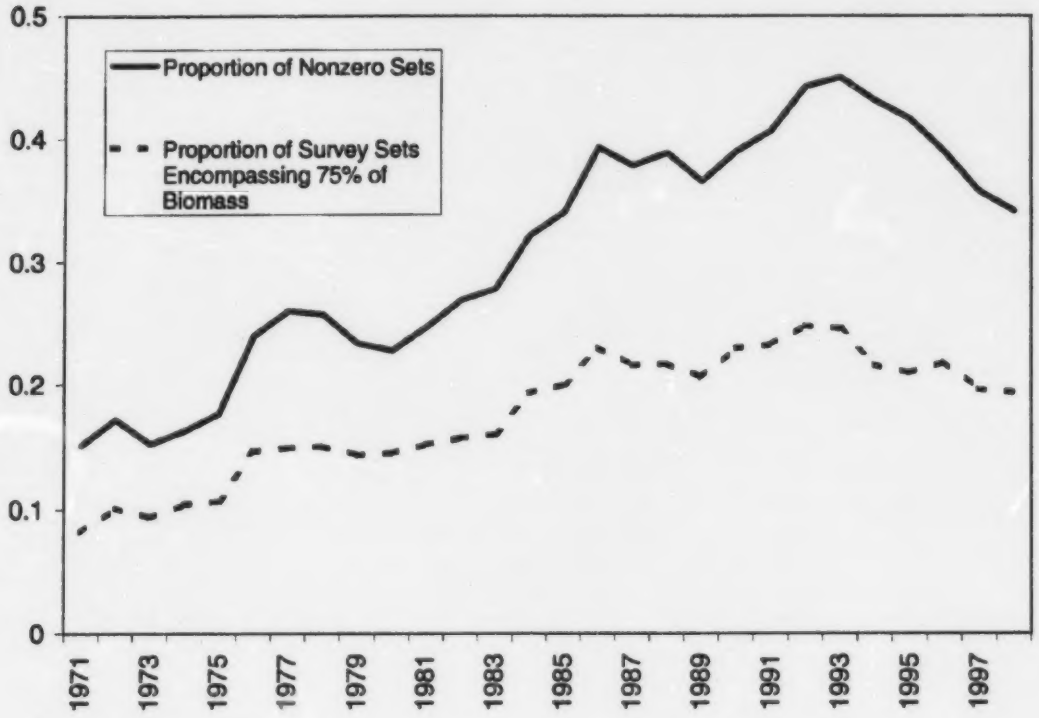


Fig. 23. Measures of pollock concentration (proportion of sets encompassing 75% of the annually estimated biomass) and geographic range (proportion of non-zero sets) from annual summer surveys conducted in NAFO Divs. 4VWX.

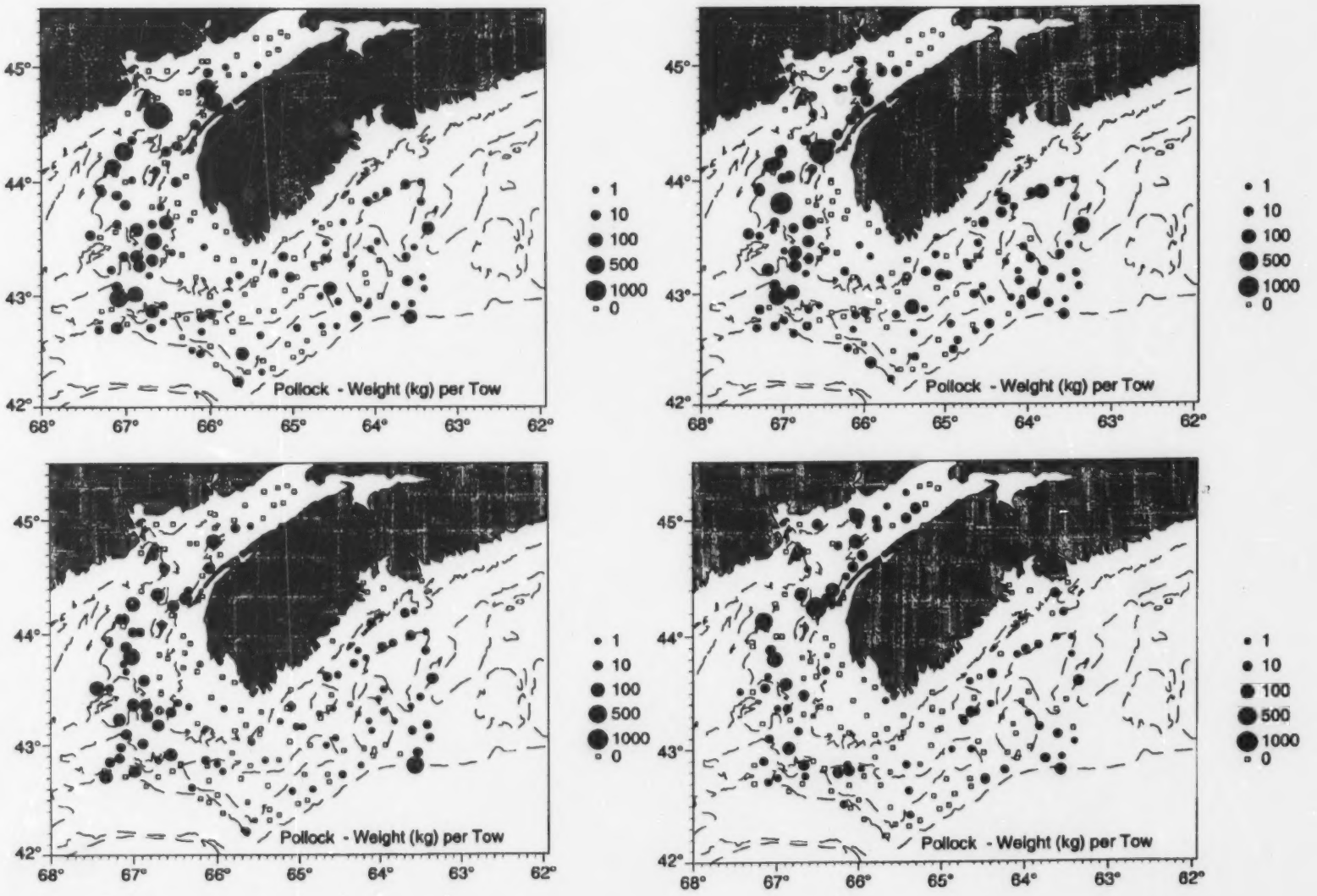


Fig. 24. Distribution of pollock (weight in kg) 1996-1999 caught during a joint industry/DFO Science survey conducted by the ITQ fleet in 4X.

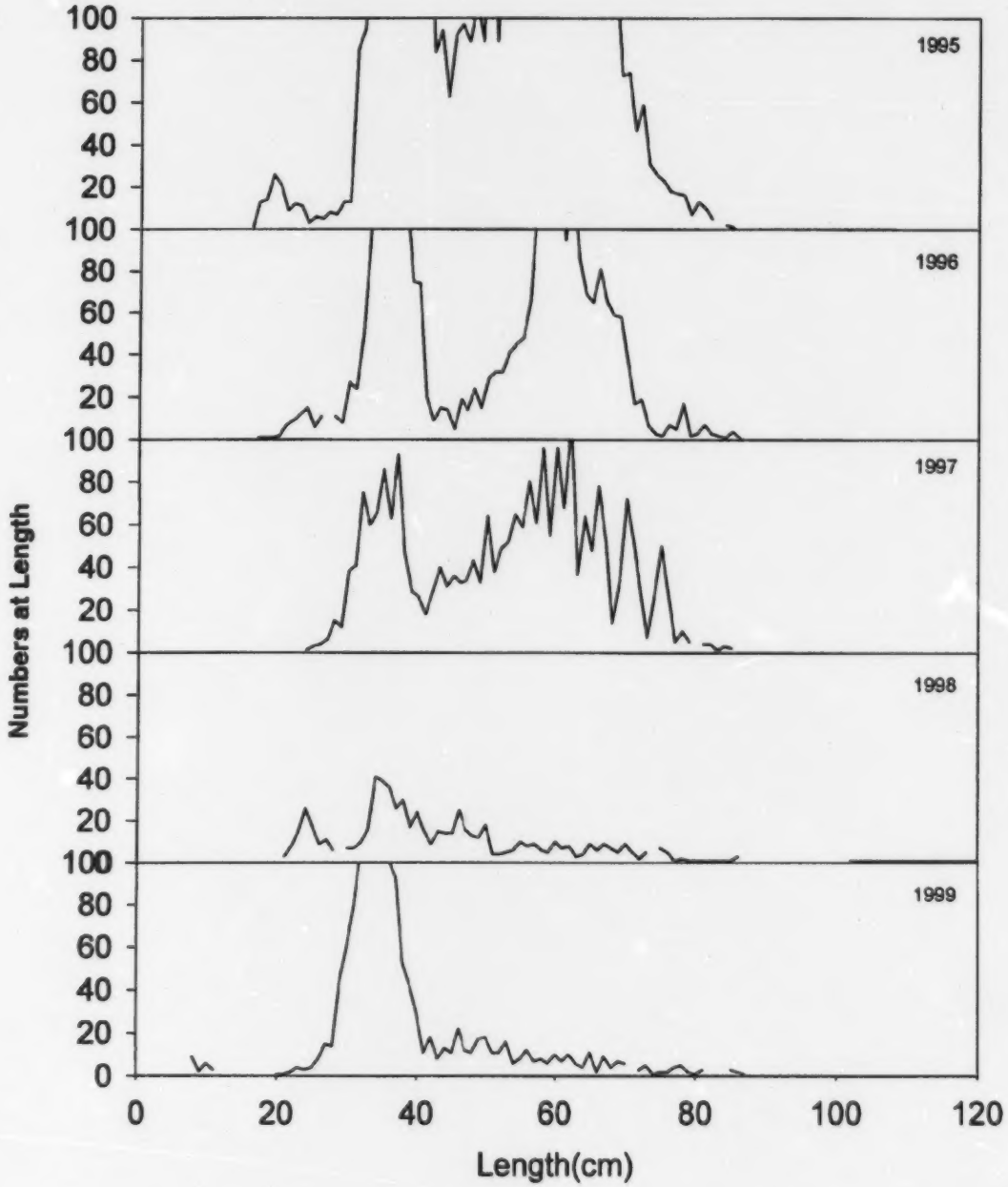


Fig. 25. Pollock length frequency, 1995-1999 from the joint industry/DFO Science survey conducted by the ITQ fleet in 4X.

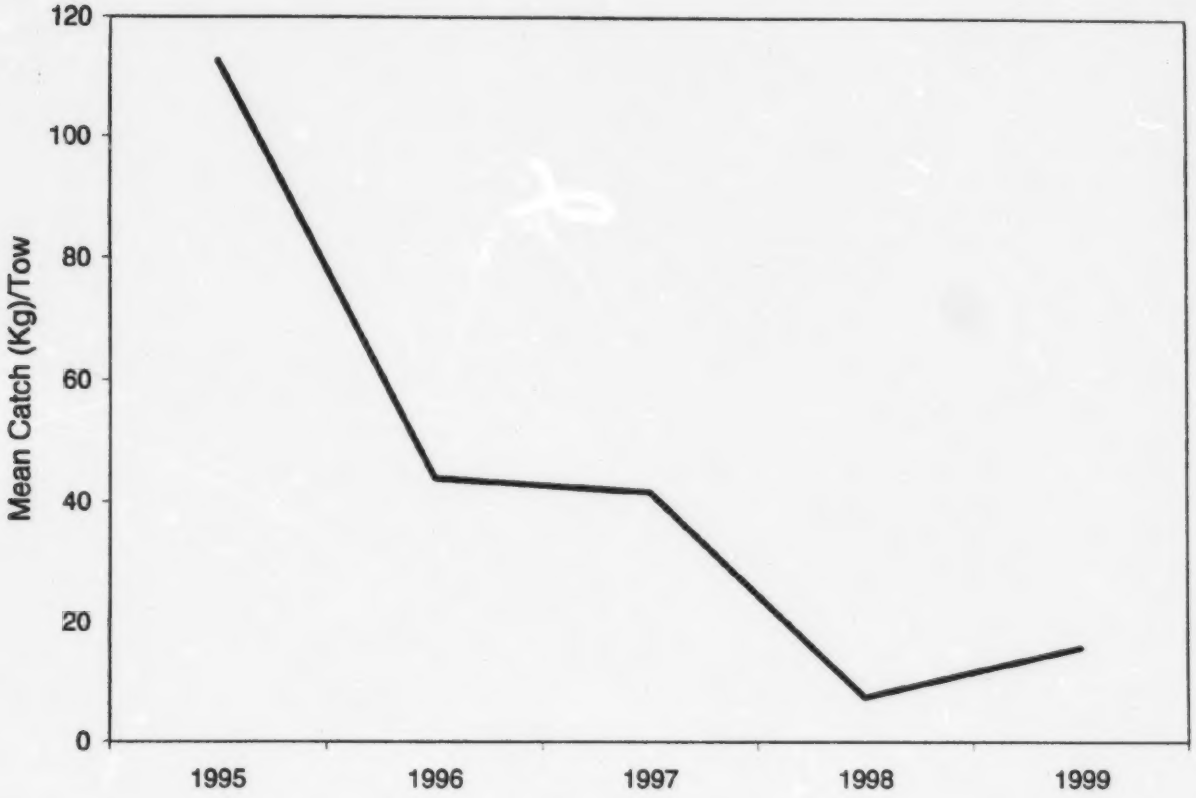


Fig.26. Mean catch per tow, 1995 – 1999 from the joint industry/DFO Science survey conducted by the ITQ fleet in 4X. Stations common to all years were used in the calculations.

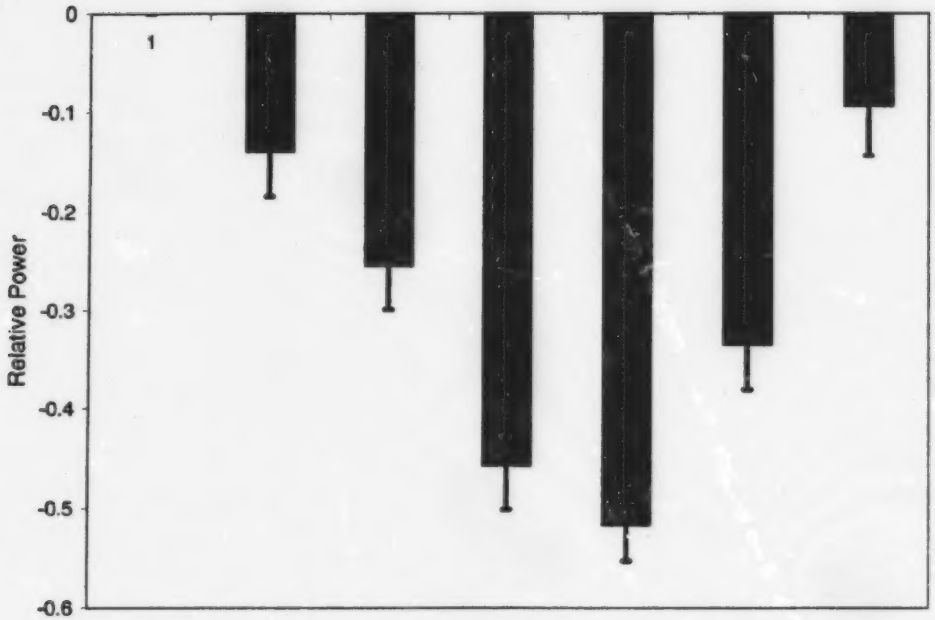


Fig. 27. Standardized catch rate series for 4VWX5Zc pollock showing the effect of month on the relative fishing power (January is the standard, and is coded 1 in the figure. Code 13 represents the months of May to October.).

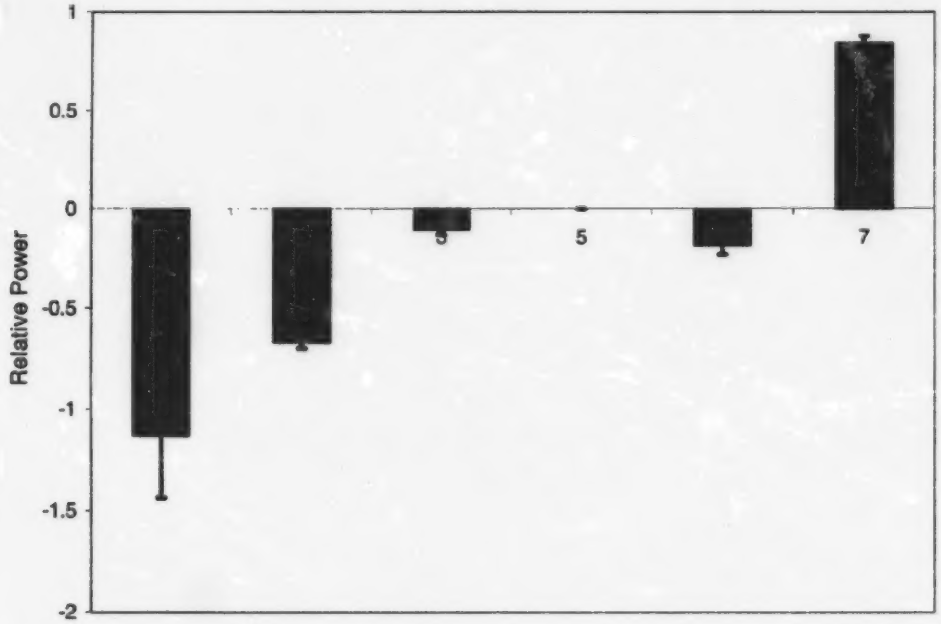


Fig. 28. Standardized catch rate series for 4VWX5Zc pollock showing the effect of tonnage class on the relative fishing power (Tonnage Class 5 is the standard).

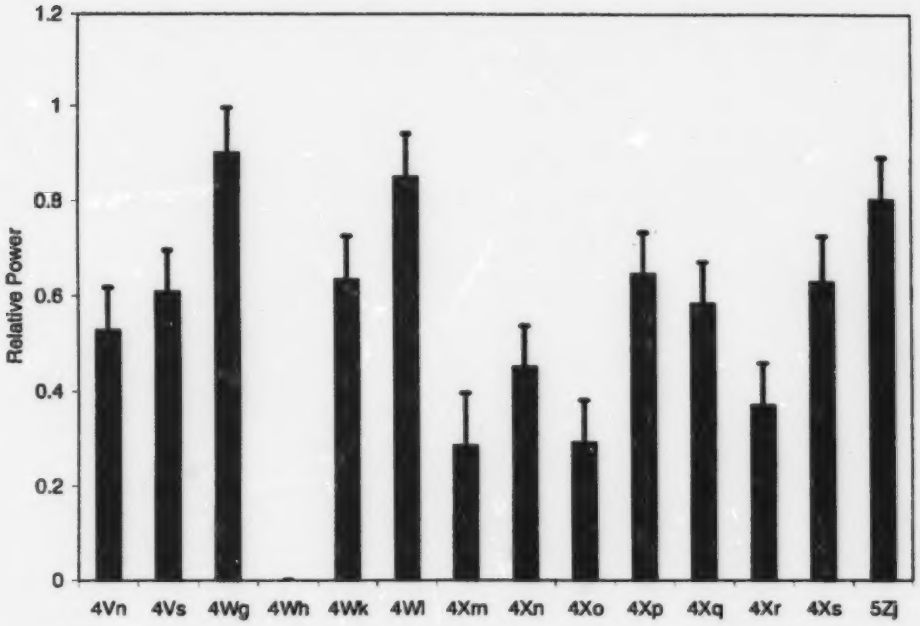


Fig. 29. Standardized catch rate series for 4VWX5Zc pollock showing the effect of unit area on the relative fishing power (unit area 4wh is the standard).

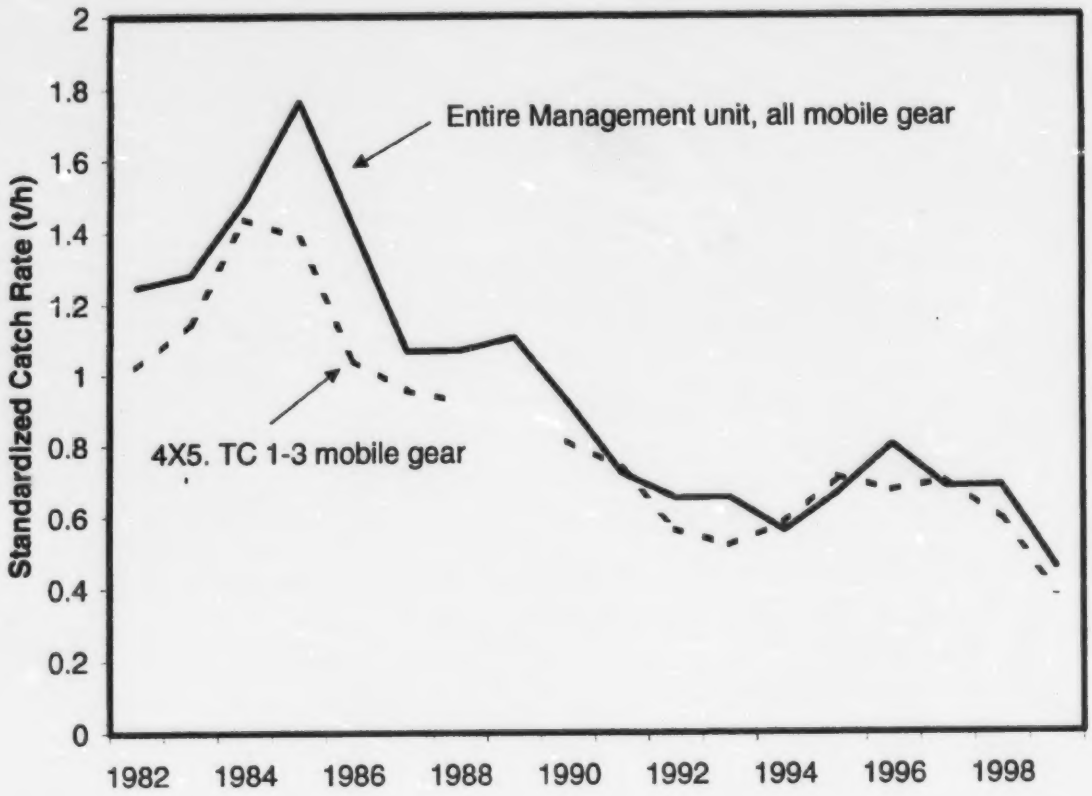


Fig. 30. Standardized catch rate series for both the entire management unit for all otter trawlers and otter trawlers Tonnage Class 1-3.

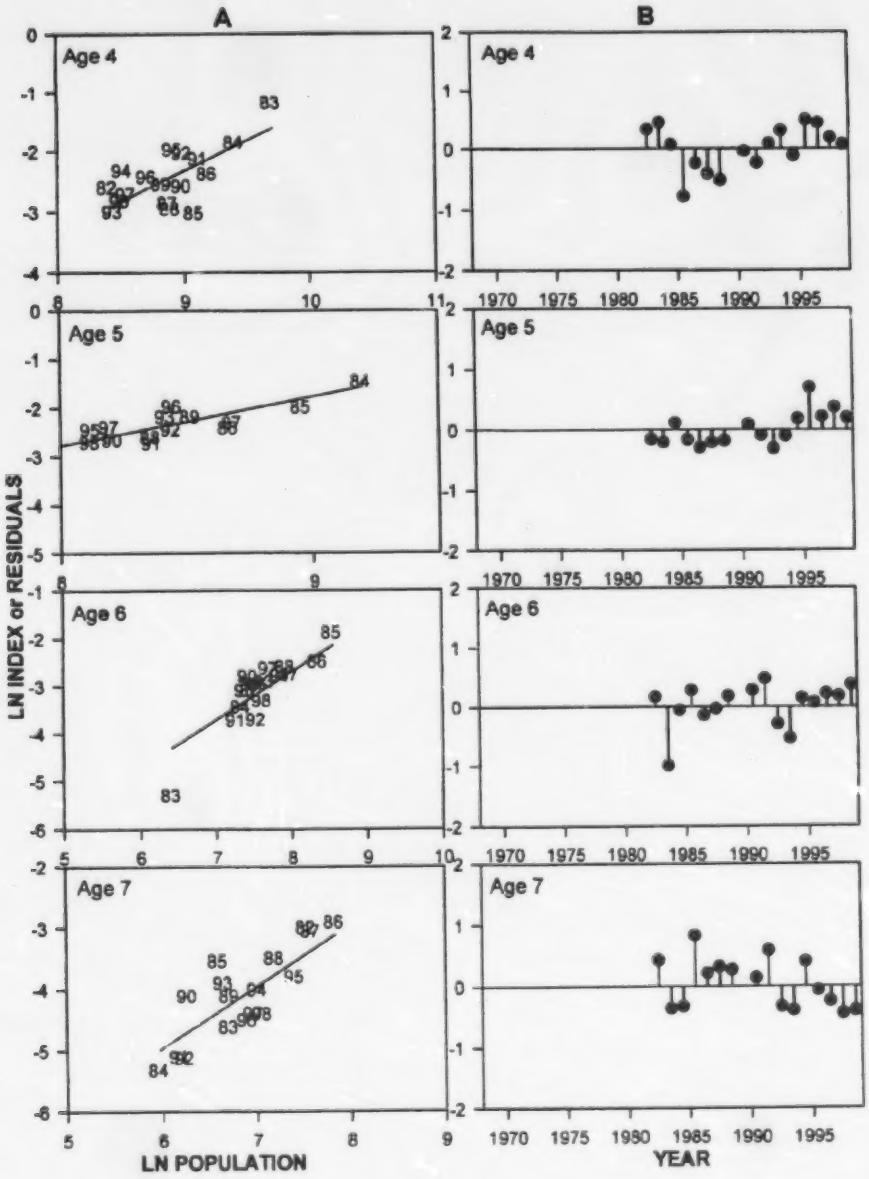


Fig. 31. Age by age residual plots of A) the observed and predicted ln abundance index versus ln population numbers, and B) residuals, for pollock in 4X5Zc pollock 1984-1999.

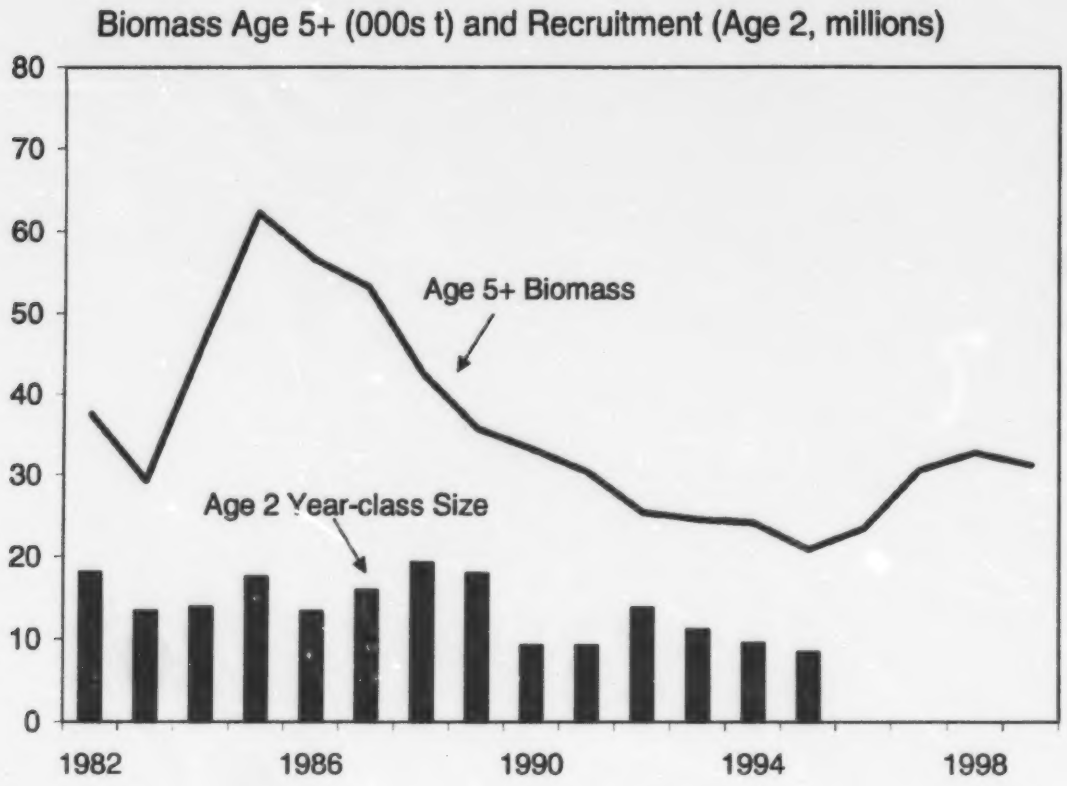


Fig. 32. Trends in age 5+ biomass and age 2 recruitment, 4VWX5Zc pollock.

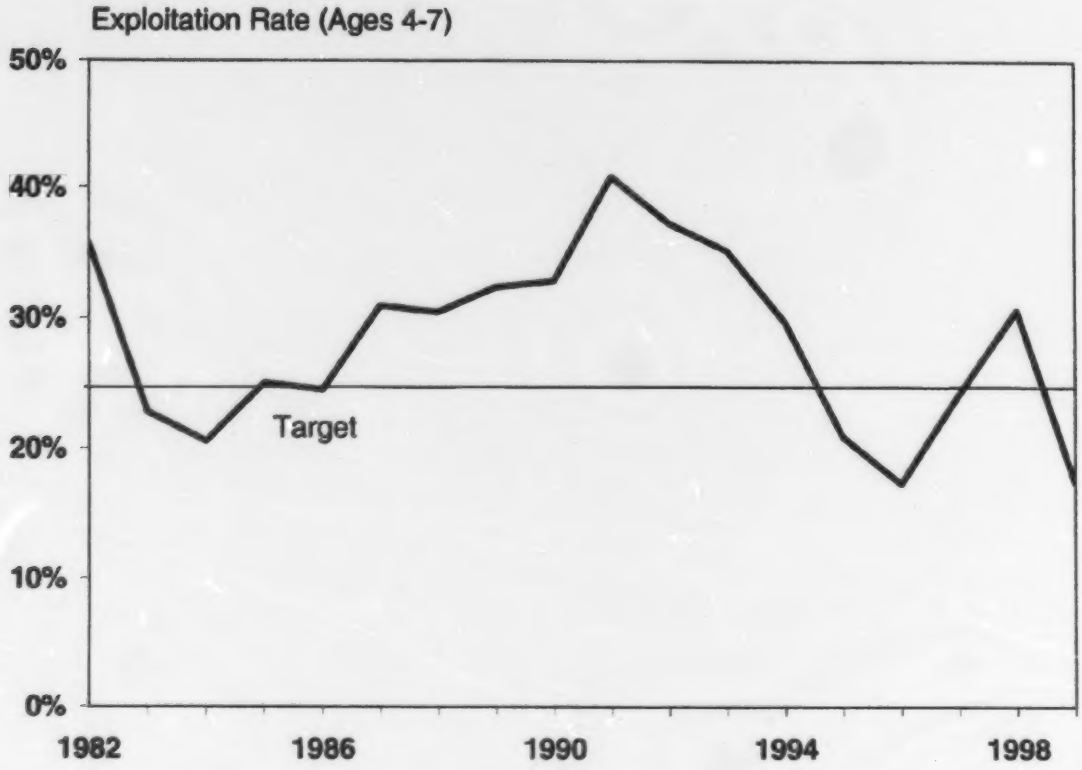


Fig. 33. Trend in exploitation rate at ages 4 – 7, 4VWX5Zc pollock.

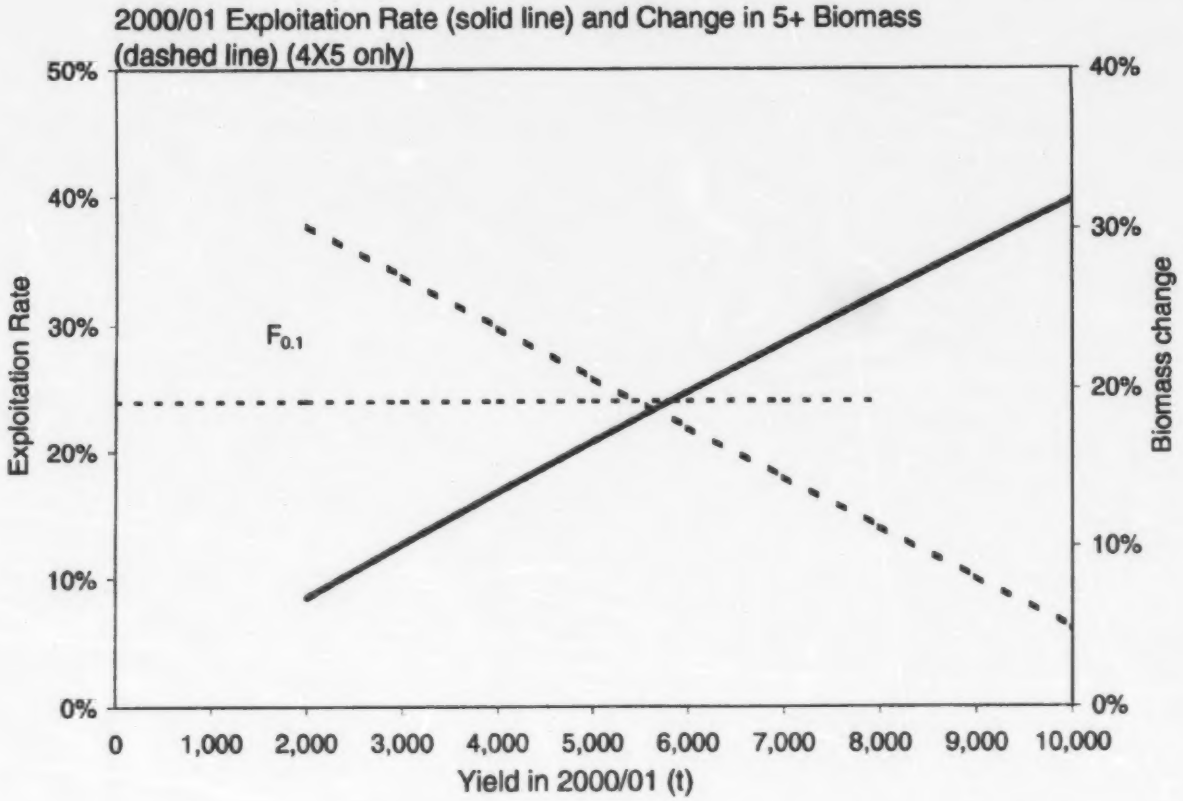


Fig. 34. Exploitation rate (solid line) and change in 5+ biomass (dashed line) in unit area 4X5 only.

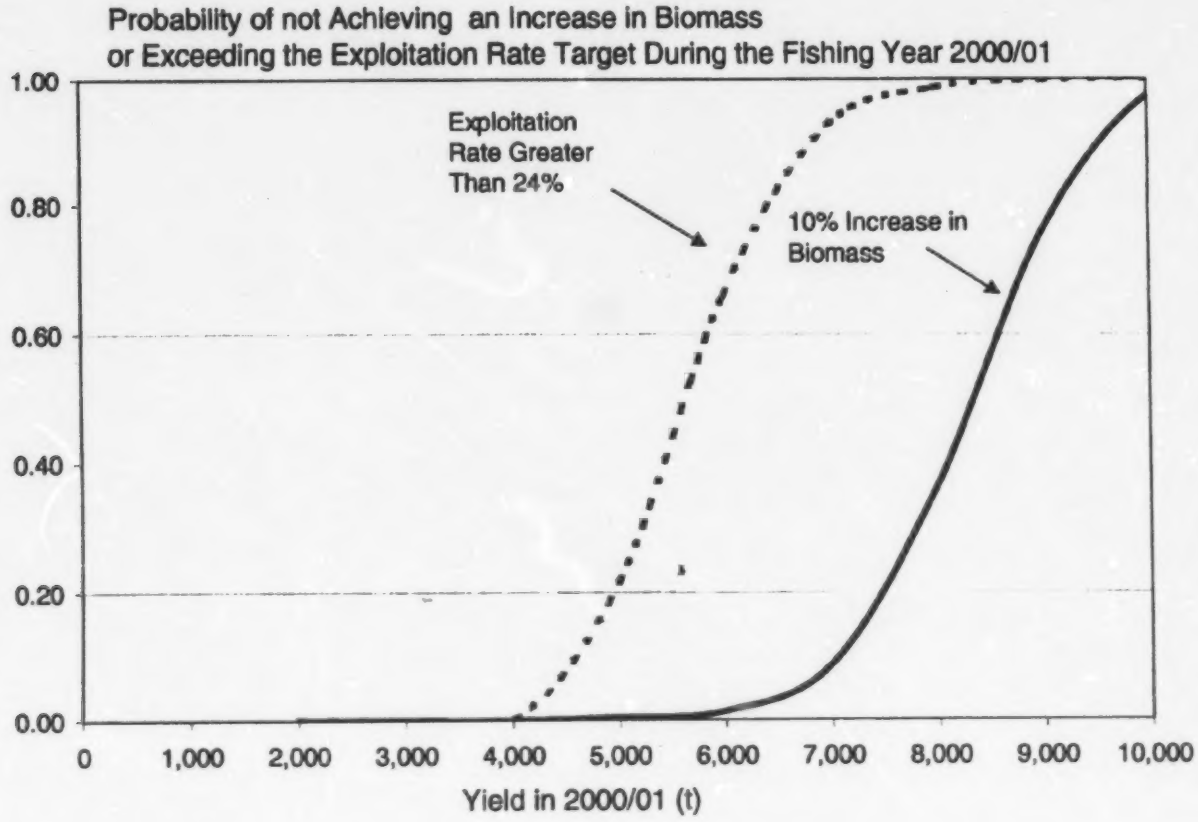


Fig. 35. Risk plot showing the probability of not achieving an increase in biomass or exceeding the exploitation rate target for the fishing year 2000/01.

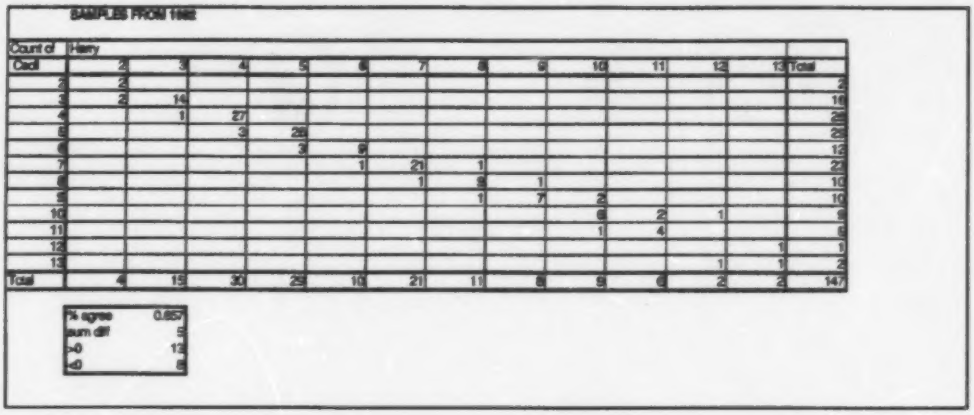
Appendix I

Precision Of Aging For 4VWX5Zc Pollock

Testing was done following established protocol to ensure the precision of ages to be used for this assessment. The protocol established ensures there is no shift or bias from the interpretation of the previous ager and also that the current ager can duplicate his own results with an acceptable level of precision. This testing is done prior to the start of production ageing and also periodically throughout the ageing process. If at any time during this process problems appeared, production ageing is immediately stopped until the problems are corrected and the affected production ages are redone. Production ageing was then resumed.

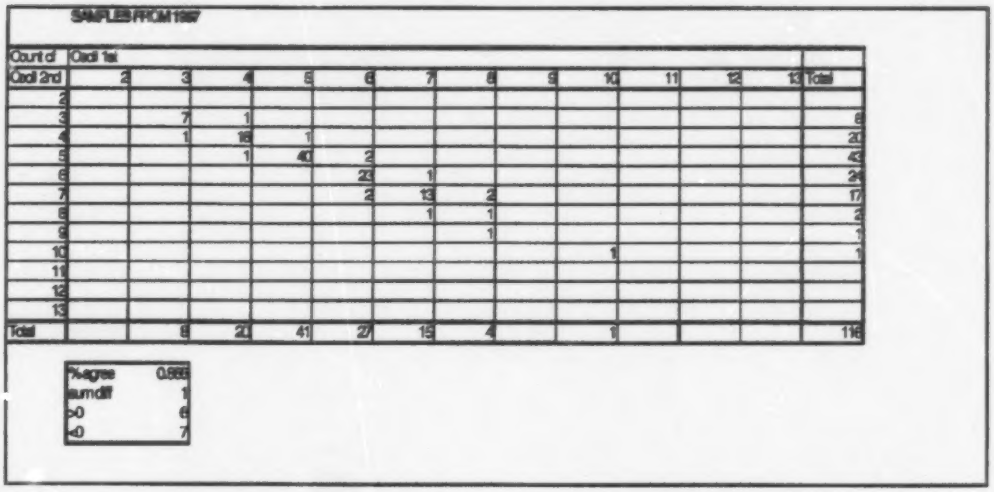
Few older fish were found in the catch at age. This prompted a re-evaluation of the ageing to ensure this wasn't a result of an incorrect interpretation of ageing material. A random selection from samples containing older fish that had been aged by the previous ager were chosen and re-aged by the current ager. This was done to show both the continued consistency between agers and to verify that if these fish appeared in today's samples they would be interpreted as they were in the past. An example of this test is shown and although there appears to be a slight bias, with the degree of difficulty of the samples taken into account the results were deemed to be acceptable.

Test 1. Shows cufrent ager against previous ager with older fish in samples.



SAMPLES FROM 1982													
Count of	Harry												
Cecil	2	3	4	5	6	7	8	9	10	11	12	13	Total
2	2												2
3	2	14											16
4		1	27										28
5			3	28									31
6				3	9								12
7					1	21	1						23
8						1	9	1					11
9							1	7	2				10
10									6	2	1		9
11									1	4			5
12												1	1
13											1	1	2
Total	4	15	30	29	10	22	11	8	9	6	2	2	147

% agree	0.857
sum diff	5
>0	12
<0	5



SAMPLES FROM 1997													
Count of	Cecil 1st												
Cecil 2nd	2	3	4	5	6	7	8	9	10	11	12	13	Total
2													
3		7	1										8
4		1	18	1									20
5			1	40	2								43
6					23	1							24
7					2	13	2						17
8						1	1						2
9							1						1
10									1				1
11													
12													
13													
Total		8	20	41	27	15	4		1				116

%agree	0.888
sumdiff	1
>0	6
<0	7

Test 2. Current ager against self using 1997 samples.

Test 2 and test 3 are examples of the testing that was done following the established protocol stated previously for precision and bias control. As shown by the figures there was no concerning bias detected and precision was considered to be good. Test 2 was done to verify there was no shift in interpretation from the previous year. Test 3 is an example of what was done during production ageing to verify there was no change during the current year's ageing.

Test 3. Current ager against this years samples.

SAMPLES FROM 1998

Count of	Oxcl 1st													
Oxcl 2nd	2	3	4	5	6	7	8	9	10	11	12	13	Total
2	7												7
3		23											23
4		1	26	2									29
5				21	1								22
6				2	8								10
7					1	5							6
8						1	2						3
9													
10													
11													
12													
13													
Total	7	24	26	25	10	6	2						98

%agree	0.918
sumdiff	2
>0	5
<0	3

Appendix II

MULTIPLE R..... 0.417
MULTIPLE R SQUARED..... 0.174

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	1.596E4	1.596E4	
REGRESSION	42	1.029E4	2.449E2	140.149
TYPE 1	17	2.095E3	1.232E2	70.520
TYPE 2	5	2.478E3	4.957E2	283.692
TYPE 3	6	6.266E2	1.044E2	59.764
TYPE 4	13	6.118E2	4.706E1	26.935
TYPE 5	1	2.649E1	2.649E1	15.161
RESIDUALS	27940	4.882E4	1.747E0	
TOTAL	27983	7.507E4		

REGRESSION COEFFICIENTS

CATEGORY	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
82 5 1 4Wh D	INTERCEPT	-0.478	0.096	27983
83	1	0.025	0.069	629
84	2	0.176	0.064	862
85	3	0.344	0.059	1216
86	4	0.124	0.061	1145
87	5	-0.158	0.055	1841
88	6	-0.157	0.056	1731
89	7	-0.124	0.055	1903
90	8	-0.307	0.052	2923
91	9	-0.551	0.050	3562
92	10	-0.655	0.051	2694
93	11	-0.653	0.053	2308
94	12	-0.806	0.058	1685
95	13	-0.631	0.068	945
96	14	-0.446	0.069	1033

97	15	-0.608	0.068	1042
98	16	-0.602	0.068	1094
99	17	-1.006	0.083	449
4	18	-0.188	0.045	988
3	19	-0.108	0.026	7529
2	20	-0.668	0.031	3660
7	21	0.846	0.033	2407
1	22	-1.129	0.306	19
2	23	-0.139	0.045	1906
3	24	-0.255	0.044	2176
4	25	-0.457	0.044	2242
11	26	-0.335	0.046	1927
12	27	-0.093	0.050	1311
13	28	-0.517	0.036	16703
4Wl	29	0.850	0.091	1193
4Xn	30	0.453	0.085	4012
4Xp	31	0.647	0.086	3253
5Zj	32	0.804	0.087	2328
4Vs	33	0.610	0.085	4677
4Xm	34	0.288	0.109	341
4Wg	35	0.902	0.094	845
4Wk	36	0.635	0.090	1428
4Xo	37	0.294	0.088	1913
4Xq	38	0.585	0.086	3286
4Xr	39	0.372	0.089	1856
4Xs	40	0.631	0.094	1024
4Vn	41	0.528	0.090	1559
S	42	-0.145	0.037	5487

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
82	-0.6496	0.0027	1.249	0.065	6309	5049
83	-0.6251	0.0035	1.280	0.076	5459	4265
84	-0.4739	0.0027	1.489	0.078	8723	5857
85	-0.3058	0.0023	1.763	0.084	10891	6179
86	-0.5252	0.0024	1.415	0.069	8918	6301
87	-0.8079	0.0017	1.067	0.044	8457	7925
88	-0.8062	0.0019	1.069	0.047	6656	6228
89	-0.7733	0.0019	1.105	0.048	5949	5386
90	-0.9565	0.0015	0.920	0.035	8898	9674
91	-1.2011	0.0013	0.720	0.026	13747	19084
92	-1.3045	0.0013	0.650	0.023	11143	17154
93	-1.3026	0.0017	0.651	0.027	7985	12272
94	-1.4557	0.0024	0.558	0.027	4553	8158
95	-1.2802	0.0037	0.665	0.040	3244	4880
96	-1.0960	0.0038	0.799	0.049	3187	3988
97	-1.2578	0.0036	0.680	0.041	4224	6213
98	-1.2512	0.0036	0.684	0.041	6291	9193
99	-1.6556	0.0057	0.456	0.035	1374	3012

APPENDIX III
VPA and Projection Results

SATURDAY, OCTOBER 23, 1999 10:49:40.450 AM

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APL Ver. 2.0.00

ADAPT_W Ver. 2.1

Workspace size = 6000000

Catch

	2	3	4	5	6	7	8	9	10	11	12
1982.00	141	2617	1460	429	1229	1375	655	230	77	56	18
1983.00	23	1206	4582	877	154	351	408	194	70	26	17
1984.00	17	502	2100	3394	532	96	162	175	74	18	4
1985.00	6	237	966	2587	2872	566	102	121	143	86	34
1986.00	3	303	1810	1965	1927	1307	135	54	42	56	26
1987.00	13	293	1349	2639	1834	1492	844	127	34	29	36
1988.00	11	372	1615	1995	1863	824	582	382	29	18	27
1989.00	34	543	2549	2153	1269	1027	369	248	130	22	9
1990.00	4	596	1536	2498	1498	708	281	237	99	42	12
1991.00	24	715	2302	2320	2331	694	293	138	81	44	19
1992.00	24	1740	3783	2509	1281	442	156	105	59	12	12
1993.00	46	741	2862	2656	1296	450	131	43	11	5	6
1994.00	57	324	823	1879	1289	578	227	89	19	9	2
1995.00	23	403	736	1107	774	344	83	23	5	1	1
1996.00	95	303	1175	842	584	346	59	14	2	1	0
1997.00	6	194	1088	1877	912	236	57	4	0	1	0
1998.00	13	362	1185	1691	1519	351	55	17	2	1	0
1999.00	1	60	459	567	414	211	29	4	1	2	0
1999.67											

TC 13 C/E

	4	5	6	7
1982.50	0.07	0.02	0.05	0.05
1983.50	0.31	0.04	0.01	0.01
1984.50	0.16	0.23	0.03	0.00
1985.50	0.05	0.14	0.15	0.03
1986.50	0.09	0.09	0.08	0.05
1987.50	0.06	0.10	0.06	0.05
1988.50	0.05	0.07	0.07	0.03
1989.50	0.00	0.00	0.00	0.00
1990.50	0.08	0.11	0.05	0.02
1991.50	0.08	0.07	0.06	0.02
1992.50	0.12	0.07	0.02	0.01
1993.50	0.13	0.09	0.02	0.01
1994.50	0.05	0.11	0.05	0.02
1995.50	0.10	0.12	0.06	0.02
1996.50	0.14	0.09	0.05	0.02
1997.50	0.09	0.14	0.05	0.01

1998.50	0.07	0.09	0.07	0.01
1999.50	0.06	0.07	0.04	0.01

VPA setup

Plus Group : No plus group

Population

	2	3	4	5	6	7	8	9	10	11	12
1999.67	(22000)	(18000)	11000	10000	5000	3000	1000	500	300	100	50

F ratios

	2	3	4	5	6	7	8	9	10	11	12
1982.00						1.00	1.00	1.00	1.00		(1.00)
1983.00						1.00	1.00	1.00	1.00		(1.00)
1984.00						1.00	1.00	1.00	1.00		(1.00)
1985.00						1.00	1.00	1.00	1.00		(1.00)
1986.00						1.00	1.00	1.00	1.00		(1.00)
1987.00						1.00	1.00	1.00	1.00		(1.00)
1988.00						1.00	1.00	1.00	1.00		(1.00)
1989.00						1.00	1.00	1.00	1.00		(1.00)
1990.00						1.00	1.00	1.00	1.00		(1.00)
1991.00						1.00	1.00	1.00	1.00		(1.00)
1992.00						1.00	1.00	1.00	1.00		(1.00)
1993.00						1.00	1.00	1.00	1.00		(1.00)
1994.00						1.00	1.00	1.00	1.00		(1.00)
1995.00						1.00	1.00	1.00	1.00	(1.00)	
1995.00						1.00	1.00	1.00	1.00		(1.00)
1996.00						1.00	1.00	1.00	1.00	(1.00)	
1997.00						1.00	1.00	1.00	1.00	(1.00)	

Natural Mortality

	2	3	4	5	6	7	8	9	10	11	12
1982.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
1983.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
1984.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
1985.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
1986.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
1987.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
1988.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
1989.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
1990.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
1991.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
1992.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
1993.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
1994.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
1995.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
1996.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
1997.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
1998.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
1999.00	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)

APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET..... 0.000785
MEAN SQUARE RESIDUALS 0.147580

Estimates for parameters

PAR. EST.	STD. ERR.	REL. ERR.	BIAS	REL. BIAS
8.45E0	4.06Eý1	0.048	2.25Eý3	0.000
8.05E0	3.23Eý1	0.040	ý1.63Eý3	0.000

7.55E0	3.15Eý1	0.042	ý5.48Eý3	-0.001
6.99E0	3.23Eý1	0.046	ý9.49Eý3	-0.001
6.54E0	3.57Eý1	0.055	ý1.90Eý2	-0.003
6.28E0	3.47Eý1	0.055	ý1.80Eý2	-0.003
6.61E0	3.30Eý1	0.050	ý1.48Eý2	-0.002
5.94E0	3.98Eý1	0.067	ý2.49Eý2	-0.004
5.01E0	5.98Eý1	0.119	ý8.08Eý2	-0.016
ý1.13E1	9.98Eý2	-0.009	ý3.81Eý3	0.000
ý1.08E1	9.93Eý2	-0.009	ý3.08Eý3	0.000
ý1.07E1	1.02Eý1	-0.010	ý1.35Eý3	0.000
ý1.10E1	1.08Eý1	-0.010	2.86Eý3	0.000

Parameters in linear scale

PAR. EST.	STD. ERR.	REL. ERR.	BIAS	REL. BIAS
4.66E3	1.89E3	0.406	3.94E2	0.084
3.13E3	1.01E3	0.323	1.58E2	0.051
1.90E3	5.98E2	0.315	8.37E1	0.044
1.09E3	3.52E2	0.323	4.64E1	0.043
6.95E2	2.48E2	0.357	3.11E1	0.045
5.32E2	1.84E2	0.347	2.24E1	0.042
7.45E2	2.46E2	0.330	2.97E1	0.040
3.81E2	1.52E2	0.398	2.07E1	0.054
1.51E2	9.00E1	0.598	1.48E1	0.098
1.20Eý5	1.20Eý6	0.100	1.42Eý8	0.001
2.09Eý5	2.08Eý6	0.099	3.89Eý8	0.002
2.22Eý5	2.27Eý6	0.102	8.62Eý8	0.004
1.74Eý5	1.88Eý6	0.108	1.51Eý7	0.009

VPA using analytical bias adjusted parameters (linear scale)

Population Numbers

	2	3	4	5	6	7	8	9	10	11	12
1982.00	23674	28356	5795	1409	2712	2966	1456	532	143	126	38
1983.00	16109	19255	20856	3433	768	1122	1200	607	230	48	53
1984.00	18127	13168	14676	12955	2022	490	604	617	323	125	16
1985.00	13447	14826	10328	10124	7558	1178	315	349	348	198	86
1986.00	13883	11004	11924	7585	5965	3617	459	167	177	157	85
1987.00	17540	11363	8736	8133	4445	3156	1790	255	88	107	78
1988.00	13329	14349	9039	5938	4292	1999	1252	712	95	42	62
1989.00	15986	10903	11412	5947	3073	1849	899	505	243	52	18
1990.00	19349	13057	8437	7052	2940	1381	600	406	192	83	23
1991.00	18068	15838	10152	5525	3535	1072	499	240	122	69	31
1992.00	9295	14772	12322	6242	2449	831	263	149	74	28	18
1993.00	9271	7588	10526	6694	2866	864	286	77	29	9	12
1994.00	13827	7549	5545	6048	3104	1189	306	117	24	14	3
1995.00	11201	11269	5888	3798	3266	1388	458	51	18	3	3
1996.00	9597	9150	8863	4158	2116	1978	828	300	21	10	2
1997.00	8509	7771	7218	6198	2647	1208	1308	624	233	15	7
1998.00	25230	6961	6188	4930	3390	1349	777	1019	508	191	12
1999.00	25156	20645	5372	4000	2520	1418	790	586	819	414	155
1999.67	22000	18000	4270	2969	1818	1044	663	509	716	360	136

Fishing Mortality

	2	3	4	5	6	7	8	9	10	11	12
1982.00	0.007	0.107	0.324	0.406	0.682	0.704	0.675	0.639	0.885	0.663	0.726
1983.00	0.002	0.072	0.276	0.329	0.249	0.420	0.465	0.431	0.406	0.883	0.431
1984.00	0.001	0.043	0.171	0.339	0.341	0.242	0.348	0.372	0.290	0.172	0.313
1985.00	0.000	0.018	0.109	0.329	0.537	0.742	0.438	0.477	0.596	0.644	0.563
1986.00	0.000	0.031	0.183	0.334	0.437	0.503	0.389	0.439	0.301	0.495	0.408

1987.00	0.001	0.029	0.186	0.439	0.599	0.725	0.722	0.782	0.549	0.351	0.694
1988.00	0.001	0.029	0.219	0.459	0.642	0.599	0.707	0.876	0.405	0.640	0.647
1989.00	0.002	0.056	0.281	0.504	0.600	0.926	0.595	0.765	0.872	0.618	0.789
1990.00	0.000	0.052	0.223	0.491	0.809	0.817	0.715	1.003	0.821	0.799	0.839
1991.00	0.001	0.051	0.286	0.614	1.248	1.206	1.013	0.978	1.264	1.163	1.115
1992.00	0.003	0.139	0.410	0.578	0.842	0.865	1.033	1.437	1.922	0.624	1.314
1993.00	0.005	0.114	0.354	0.569	0.680	0.837	0.691	0.941	0.538	0.949	0.752
1994.00	0.005	0.048	0.178	0.416	0.604	0.755	1.598	1.682	1.790	1.219	1.456
1995.00	0.002	0.040	0.148	0.385	0.301	0.317	0.222	0.683	0.366	0.397	0.397
1996.00	0.011	0.037	0.158	0.252	0.361	0.214	0.082	0.053	0.111	0.115	0.000
1997.00	0.001	0.028	0.181	0.403	0.474	0.242	0.049	0.007	0.000	0.074	0.000
1998.00	0.001	0.059	0.236	0.471	0.671	0.336	0.081	0.019	0.004	0.006	0.000
1999.00	0.000	0.005	0.143	0.245	0.288	0.258	0.060	0.011	0.002	0.008	0.000

TUESDAY, OCTOBER 26, 1999 4:56:04.220 PM
APL Ver. 2.0.00

ADAPT_W Ver. 2.1

Workspace size = 6000000

Population abundance was copied to clipboard

Fishing mortality was copied to clipboard

BOOTSTRAP STATISTICS
Estimates for parameters

PAR. EST.	STD. ERR.	REL. ERR.	BIAS	REL. BIAS
8.45E0	3.69Eý1	0.044	ý4.89Eý6	0.000
8.05E0	2.97Eý1	0.037	8.20Eý3	0.001
7.55E0	2.85Eý1	0.038	2.72Eý3	0.000
6.99E0	3.01Eý1	0.043	ý2.13Eý2	-0.003
6.54E0	3.30Eý1	0.050	ý1.84Eý2	-0.003
6.28E0	3.26Eý1	0.052	1.50Eý2	0.002
6.61E0	3.20Eý1	0.048	ý1.48Eý2	-0.002
5.94E0	3.69Eý1	0.062	ý1.11Eý2	-0.002
5.01E0	5.99Eý1	0.119	ý5.18Eý2	-0.010
ý1.13E1	9.08Eý2	-0.008	ý1.93Eý3	0.000
ý1.08E1	9.38Eý2	-0.009	ý1.40Eý2	0.001
ý1.07E1	9.30Eý2	-0.009	1.23Eý3	0.000
ý1.10E1	9.52Eý2	-0.009	ý1.91Eý3	0.000

Parameters in linear scale

PAR. EST.	STD. ERR.	REL. ERR.	BIAS	REL. BIAS
4.66E3	1.80E3	0.387	1.17E2	0.068
3.13E3	9.60E2	0.307	1.64E2	0.052
1.90E3	5.55E2	0.292	8.22E1	0.043
1.09E3	3.26E2	0.299	2.49E1	0.023
6.95E2	2.20E2	0.317	2.28E1	0.033
5.32E2	1.77E2	0.334	3.62E1	0.068
7.45E2	2.29E2	0.308	2.51E1	0.034
3.81E2	1.47E2	0.386	2.15E1	0.057
1.51E2	8.40E1	0.558	1.55E1	0.103
1.20Eý5	1.09Eý6	0.091	2.62Eý8	0.002
2.09Eý5	1.98Eý6	0.095	ý2.00Ey7	-0.010
2.22Eý5	2.09Eý6	0.094	1.24Eý7	0.006
1.74Eý5	1.66Eý6	0.096	4.56Eý8	0.003

Bootstrap bias adjusted VPA
Population Numbers

	2	3	4	5	6	7	8	9	10	11	12
1982.00	23674	28356	5795	1409	2712	2966	1456	532	143	126	38
1983.00	16110	19255	20856	3433	768	1122	1200	607	230	48	53
1984.00	18127	13169	14677	12955	2022	490	604	617	323	125	16
1985.00	13448	14826	10328	10125	7558	1178	315	349	348	198	86
1986.00	13884	11005	11924	7585	5965	3617	459	167	177	157	85
1987.00	17545	11364	8737	8133	4445	3156	1790	255	88	107	78
1988.00	13330	14353	9040	5938	4292	1999	1252	712	95	42	62
1989.00	15983	10904	11415	5948	3073	1849	900	505	243	52	18
1990.00	19346	13055	8437	7054	2941	1381	600	406	192	83	23
1991.00	18096	15836	10150	5525	3537	1072	500	240	122	69	31
1992.00	9231	14794	12320	6241	2449	832	263	149	74	28	18
1993.00	9304	7536	10544	6692	2865	864	288	77	29	9	12
1994.00	13897	7576	5502	6062	3102	1187	306	118	25	14	3
1995.00	11206	11326	5910	3764	3277	1387	456	51	19	3	3
1996.00	9585	9154	8909	4176	2088	1987	826	299	21	11	2
1997.00	8640	7761	7221	6236	2661	1185	1316	623	232	15	8
1998.00	14058	7069	6179	4932	3421	1361	758	1026	506	190	12
1999.00	13150	11498	5460	3993	2522	1443	799	571	824	413	154
1999.67	11500	10000	4347	2963	1819	1065	672	495	720	359	135

Fishing Mortality

	2	3	4	5	6	7	8	9	10	11	12
1982.00	0.007	0.107	0.324	0.406	0.682	0.704	0.675	0.639	0.885	0.663	0.726
1983.00	0.002	0.072	0.276	0.329	0.249	0.420	0.465	0.431	0.406	0.883	0.431
1984.00	0.001	0.043	0.171	0.339	0.341	0.242	0.348	0.372	0.290	0.172	0.313
1985.00	0.000	0.018	0.109	0.329	0.537	0.742	0.438	0.477	0.596	0.644	0.563
1986.00	0.000	0.031	0.183	0.334	0.437	0.503	0.389	0.439	0.301	0.495	0.408
1987.00	0.001	0.029	0.186	0.439	0.599	0.725	0.722	0.782	0.549	0.351	0.694
1988.00	0.001	0.029	0.219	0.459	0.642	0.598	0.707	0.875	0.405	0.640	0.647
1989.00	0.002	0.056	0.281	0.504	0.600	0.926	0.595	0.765	0.872	0.618	0.789
1990.00	0.000	0.052	0.223	0.490	0.809	0.817	0.715	1.002	0.821	0.798	0.839
1991.00	0.001	0.051	0.286	0.614	1.247	1.205	1.011	0.977	1.263	1.162	1.114
1992.00	0.003	0.138	0.408	0.575	0.842	0.862	1.031	1.430	1.918	0.623	1.310
1993.00	0.005	0.114	0.350	0.562	0.665	0.836	0.687	0.936	0.532	0.942	0.748
1994.00	0.005	0.048	0.178	0.407	0.584	0.690	1.590	1.639	1.747	1.182	1.416
1995.00	0.002	0.040	0.146	0.382	0.288	0.292	0.173	0.665	0.338	0.367	0.367
1996.00	0.011	0.037	0.156	0.247	0.352	0.198	0.072	0.035	0.106	0.102	0.000
1997.00	0.001	0.027	0.178	0.396	0.456	0.230	0.044	0.006	0.000	0.070	0.000
1998.00	0.001	0.052	0.225	0.454	0.640	0.309	0.075	0.017	0.004	0.003	0.000
1999.00	0.000	0.008	0.123	0.227	0.268	0.234	0.053	0.010	0.002	0.007	0.000

Projection results using bootstrap bias adjusted point estimates
Projected Population Numbers

	2	3	4	5	6	7	8	9	10	11	12
1999.67	11500	10000	4347	2963	1819	1065	672	495	720	359	135
2000.25	11500	10214	8676	3442	2142	1248	811	575	435	633	316
2001.25	11500	9387	8115	6206	2217	1299	854	635	464	351	511

Fishing Mortality

	2	3	4	5	6	7	8	9	10	11	12
1999.67	0.004	0.045	0.202	0.359	0.449	0.270	0.067	0.022	0.022	0.022	0.000
2000.25	0.003	0.030	0.135	0.240	0.300	0.180	0.045	0.015	0.015	0.015	0.000

M

	2	3	4	5	6	7	8	9	10	11	12
1999.67	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

2000.25	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

PR

	2	3	4	5	6	7	8	9	10	11	12
1999.67	0.01	0.10	0.45	0.80	1.00	0.60	0.15	0.05	0.05	0.05	0.00
2000.25	0.01	0.10	0.45	0.80	1.00	0.60	0.15	0.05	0.05	0.05	0.00

Beg Wt

	2	3	4	5	6	7	8	9	10	11	12
1999.67	0.63	0.94	1.35	1.84	2.50	3.19	3.87	4.46	5.25	5.92	6.28
2000.25	0.63	0.94	1.35	1.84	2.50	3.19	3.87	4.46	5.25	5.92	6.28
2001.25	0.63	0.94	1.35	1.84	2.50	3.19	3.87	4.46	5.25	5.92	6.28

Projected Population Biomass

	2	3	4	5	6	7	8	9	10	11	12	2+	3+	4+	5+
1999.67	7245	9400	5868	5451	4548	3397	2600	2209	3781	2127	848	47475	40230	30830	24961
2000.25	7245	9601	11712	6334	5354	3982	3139	2566	2286	3747	1983	57949	50704	41103	29391
2001.25	7245	8824	10956	11419	5543	4144	3304	2831	2436	2079	3206	61986	54741	45917	34962

Projected Catch Numbers

	2	3	4	5	6	7	8	9	10	11	12
1999.67	28	243	455	527	395	146	24	6	9	4	0
2000.25	31	274	995	668	506	187	32	8	6	9	0
2001.25											

Avg Wt

	2	3	4	5	6	7	8	9	10	11	12
1999.67	0.72	1.13	1.60	2.14	2.86	3.48	4.23	4.80	5.77	6.60	6.76
2000.25	0.72	1.13	1.60	2.14	2.86	3.48	4.23	4.80	5.77	6.60	6.76

Projected Catch Biomass

	2	3	4	5	6	7	8	9	10	11	12	2+	3+	4+	5+
1999.67	20	275	727	1129	1130	507	103	29	51	29	0	4000	3980	3705	2978
2000.25	22	309	1592	1430	1446	651	137	37	34	56	0	5716	5693	5384	3791
2001.25															

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